United States Department of the Interior

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In Reply Refer To:
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February 21, 2003

Cons. # 2-22-03-F-0129

Memorandum

To: Area Manager, Albuquerque Area Office, Bureau of Reclamation

From: Regional Director, Region 2

Subject: Draft Biological and Conference Opinions on the Effects of Actions Associated with the Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico

This document transmits the U.S. Fish and Wildlife Service's (Service) draft biological and conference opinions on the effects of actions associated with the "Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico." The duration of this action is from March 1, 2003, through February 28, 2013. This assessment partially incorporates the 2001 biological assessment submitted to the Service on June 8, 2001, for "U.S. Bureau of Reclamation's Discretionary Actions Related to Water Management, U.S. Army Corps of Engineers Water Operations Rules, and Non-Federal Actions Related to Ordinary Operations on the Middle Rio Grande, New Mexico," for the period June 30, 2001, through December 31, 2003 (Reclamation 2001). This 10-year assessment concerns the effects of the action on the endangered Rio Grande silvery minnow *(Hybognathus amarus)* (silvery minnow) and its designated critical habitat, the endangered southwestern willow flycatcher *(Empidonax traillii extimus)* (flycatcher), the threatened bald eagle (*Haliaeetus leucocephalus*), and the endangered interior least tern (*Sterna antillarum athalassos*). Your request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.), was received on February 19, 2003. The

Bureau of Reclamation (Reclamation) is the lead Federal agency, representing the Army Corps of Engineers (Corps) and non-Federal agencies that are parties to this consultation.

These draft biological and conference opinions are based on information submitted in the biological assessment dated February 19, 2003; meetings between the Service and Reclamation, the Corps, and non-Federal agencies; and other sources of information. A complete administrative record of this consultation is on file at the Service's New Mexico Ecological Services Field Office (NMESFO).

Reclamation has requested concurrence with the determination of "may affect, is not likely to adversely affect" the bald eagle and interior least tern. The February 19, 2003, biological assessment describes proposed conservation measures that Reclamation will implement to avoid potential adverse impacts to the bald eagle and interior least tern. With implementation of all proposed conservation measures for the bald eagle and interior least tern, the Service concurs with Reclamation's determination of "may affect, is not likely to adversely affect" these two species. If the conservation measures for the bald eagle and interior least tern are not carried out as proposed, Reclamation must contact the Service to determine if further consultation is necessary.

The remainder of these draft biological and conference opinions will deal with the effects of implementation of the proposed action on the silvery minnow and its critical habitat and on the flycatcher. Reclamation has determined that the proposed action "may affect, and is likely to adversely affect" the silvery minnow and flycatcher and "may adversely modify" designated critical habitat of the silvery minnow. The designation of critical habitat for the silvery minnow was published on February 19, 2003 (68 FR 8088). The final designation of critical habitat will become effective on March 21, 2003. The biological and conference opinions will be finalized before March 1, 2003. Reclamation has requested a formal conference opinion on the proposed designation; however, the Service has elected to provide a formal conference opinion on the final designation, because the designation will become effective less than two weeks after the biological and conference opinions are finalized an the final designation is slightly different than the proposed designation. At that time, Reclamation can request in writing that the Service confirm this conference opinion as a biological opinion issued through formal consultation. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the action and no further section 7 consultation will be necessary.

Consultation History

On June 8, 2001, Reclamation and the Corps submitted to the Service a biological assessment for proposed "U.S. Bureau of Reclamation's Discretionary Actions Related to Water Management, U.S. Army Corps of Engineers Water Operations Rules, and Non-Federal Actions Related to Ordinary Operations on the Middle Rio Grande, New Mexico," for the period June 30, 2001, through December 31, 2003 (Reclamation 2001). The Service issued a final biological opinion on June 29, 2001, concluding that the proposed actions were likely to jeopardize the continued existence of the silvery minnow and the flycatcher, and it contained a reasonable and prudent alternative and incidental take statement, which the Federal agencies are implementing.

Although the consultation was to be effective through December 31, 2003, in June 2002, Reclamation predicted it would not be possible to meet the biological opinion's flow requirements for the remainder of the water year because of extreme drought. On August 2, 2002, Reclamation submitted a request for reinitiation of section 7 consultation. This request was subsequently amended by a letter on August 30, 2002. On September 12, 2002, the Service issued a new biological opinion addressing proposed water management through December 31, 2002. The new biological opinion found that Reclamation's proposed action was likely to jeopardize the continued existence of the silvery minnow, and that there was no reasonable and prudent alternative to the proposed action. Late season rains enabled Reclamation to use its remaining supplemental water consistent with the June 2001 biological opinion and its incidental take statement. Therefore, the June 2001 biological opinion remained in effect throughout the 2002 water year, and the September 12, 2002, biological opinion was not implemented. On September 23, 2002, Federal District Court Judge Parker entered an order that found the September 12, 2002, biological opinion to be arbitrary and capricious, and he ordered, (1) Reclamation to release San Juan-Chama Project water to maintain river flows ordered by the Court and, (2) Reclamation and the Service to reinitiate consultation. On October 17, 2002, the Tenth Circuit Court of Appeals issued a stay of Judge Parker's order. The Tenth Circuit Court of Appeals heard arguments for this case on January 14, 2003.

In accordance with Judge Parker's ruling, Reclamation, the Corps, and the Service are reinitiating consultation on water management activities on the Middle Rio Grande. Numerous meetings among involved Federal and State agencies, Pueblos and parties to the consultation have been conducted regarding reinitiation of this consultation. On January 28, 2003, Reclamation released the draft biological assessment for this consultation and issued a final assessment on February 19, 2003.

Because the Department of the Interior must begin the consultation process prior to the resolution of the legal issues presented in the appeals to Tenth Circuit Court, we have analyzed the full spectrum of water management options described in the February 19, 2003, final biological assessment. In this biological opinion, we have analyzed the threats to the species and have developed alternatives based on biological needs of the species, independent of sources of water and discretionary authority.

BIOLOGICAL AND CONFERENCE OPINIONS

I. Description of the Proposed Action

Background

In 1999, several environmental groups, represented by the Land and Water Fund of the Rockies, sued Reclamation and the Corps for alleged violations of the ESA and the National Environmental Policy Act. As this litigation has progressed, Reclamation's authorities have been further defined by the Federal District Court of New Mexico in two rulings. The District Court held that (1) Reclamation has authority to restrict diversions by the Middle Rio Grande Conservancy District (MRGCD) through the Middle Rio Grande Project, and (2) Reclamation can use water from the San Juan-Chama and/or Middle Rio Grande Projects directly for endangered species purposes, even in cases where shortages to project contractors would result.

Aspects of the District Court's ruling have been appealed by the United States and other parties, and oral arguments were heard by the Tenth Circuit Court on January 14, 2003. Reclamation anticipates that the Tenth Circuit Court's ruling will further address the scope of its authority and that this Court will issue its ruling in time to provide guidance for the 2003 irrigation season. However, the decision will likely be issued just prior to when irrigation water deliveries could begin on March 1, 2003. In order to prepare for a Court decision in time to proceed for the 2003 irrigation season, the Department of Justice agreed that the Federal agencies would consult on two proposals for 2003. The first proposal would assume that the Court agreed with appellants that Reclamation's discretion is limited, and the second would assume that the Tenth Circuit Court upholds the District Court's ruling that Reclamation has discretion over Project water.

Therefore, Reclamation has proposed one standardized action that includes contractual water deliveries and other Project operations and has also submitted Appendix A and B that describe Reclamation's available discretion, based on the Court's future ruling, to undertake measures that avoid jeopardy or protect and conserve listed species. Appendix A would apply if the Court finds limited discretion, and Appendix B details additional discretion available for conservation measures if the Court rules that Reclamation has discretion over Project water.

Action Area

For purposes of this document, the "Middle Rio Grande" is defined as the area from the headwaters of the Rio Chama watershed and the Rio Grande, including all tributaries, from the Colorado/New Mexico state line downstream to the headwaters of Elephant Butte Reservoir. For discussion relating to Federal discretionary actions related to water operations, the Middle Rio Grande below Cochiti Dam is further designated by four divisions/reaches defined by locations of mainstream irrigation diversion dams. The Cochiti Division/Reach extends from Cochiti Dam to Angostura Diversion Dam. The reach from Angostura Diversion Dam to Isleta Diversion Dam is called the Angostura Division/Reach. The Isleta Division/Reach is bounded upstream by Isleta Diversion Dam and downstream by San Acacia Diversion Dam. Finally, the reach below San Acacia Diversion Dam to the headwaters of Elephant Butte Reservoir is the San Acacia Division/Reach.

For discussions about geomorphology and Reclamation's river maintenance program, the following reaches and associated designations are used:

Reach Name	Description
Velarde	Velarde, New Mexico to Rio Chama Confluence
Española	Rio Chama Confluence to Otowi
White Rock Canyon	Otowi to the headwaters of Cochiti Reservoir
Cochiti	Cochiti Dam to Bernalillo-Highway 44
Middle	Bernalillo-Highway 44 to Isleta Diversion Dam
Belen	Isleta Diversion Dam to Rio Puerco Confluence
Rio Puerco	Rio Puerco Confluence to San Acacia Diversion Dam
Socorro	San Acacia Diversion Dam to River Mile 78
San Marcial	River Mile 78 to Headwaters of Elephant Butte Reservoir
Hot Springs	Elephant Butte Dam to headwaters of Caballo Reservoir

River maintenance analyses include the entire Project area with the exclusion of the reach from Otowi to Cochiti Dam. At the Otowi gage, the Rio Grande enters White Rock Canyon. This reach includes not only the deep narrow canyon, but also Cochiti Lake, a Corps flood control facility. No future river maintenance activities are expected to occur within this reach.

Standardized Proposed Action

The Rio Grande Compact of 1938 (Compact) sets depletion limits on the Rio Grande, resulting in a reliable description of flows. The Middle Rio Grande Basin is a Declared Ground Water Basin, which means that the New Mexico State Engineer has determined that ground water usage impacts surface flows of the Rio Grande and must be offset, creating further assurance that flow descriptions will be reliable, even if particular actions maintaining flows change. Therefore, particular actions that do not affect net depletions of water are not specifically described in this proposed action, because they do not affect river flows.

The following sections contain descriptions of actions taking place within depletion limits under the Compact. Generally, the actions under consultation are depletions and diversions of water, although some specific actions under consultation are identified and described, such as river maintenance. Actions that may affect threatened or endangered species or their habitats other than flows in the river are generally described for non-Federal entities, and programmatically described for Federal entities.

Non-Federal Actions

Middle Rio Grande water operations must be conducted in conformance with the Compact administered by the Rio Grande Compact Commission. The Commission is composed of a Commissioner from Colorado, New Mexico, and Texas, as well as a Federal Commissioner who chairs Commission meetings. Colorado is prohibited from accruing a debit, or under-delivery to the downstream States, of more than 100,000 acre feet (af), while New Mexico's accrued debit to Texas is limited to 200,000 af. These limits may be exceeded if caused by holdover storage in certain reservoirs, but water must be retained in the reservoirs to the extent of the accrued debit. Any deviation from the terms of the Compact requires unanimous approval from the three State Commissioners.

In order to meet delivery obligations under the Compact, depletions within New Mexico are carefully controlled. Allowable depletions above the Otowi gauge located outside of Santa Fe are confined to levels defined in the Compact. Allowable depletions below Otowi gauge and above the headwaters of Elephant Butte Reservoir are calculated based on the flows passing through Otowi gauge. The maximum allowable depletions below Otowi gauge are limited to 405,000 af, in addition to tributary inflows. In an average year, when 1,100,000 af of water passes the gauge, approximately 393,000 af of water is allowed to be depleted below Otowi gauge, in addition to tributary inflows. In the dry year of 1977, for example, allowable depletions were 264,600 af in addition to tributary inflows.

The following is a non-exhaustive list of non-Federal entities and proposed non-Federal actions:

State of New Mexico

- The Office of the State Engineer grants State water rights permits and is responsible for ensuring that applicants meet State permit requirements and otherwise enforcing the water laws of the State.
- The Interstate Stream Commission is authorized to develop, conserve, and protect the waters and stream systems of the State and is responsible for representing New Mexico's interests in making interstate stream deliveries, and for investigating, planning, and developing the State's water supplies. The State cooperates with Reclamation to perform annual construction and maintenance work under the State of New Mexico Cooperative Program. In the past, this work has included river maintenance on the Rio Chama, maintenance of Drain Unit 7, drain and canal maintenance within the Bosque del Apache National Wildlife Refuge, similar work at the State refuges, and temporary pilot channels into Elephant Butte Reservoir.
- The New Mexico Department of Game and Fish administers programs concerned with conservation of endangered species and game and fish resources. It also manages the La Jolla State Game Refuge and Bernardo Waterfowl Area.
- The New Mexico Environment Department administers the State's water quality program.

Counties

Counties that border the Rio Grande and Rio Chama and their respective tributaries conduct actions that can affect these rivers. County actions can influence water management by providing for general development and infrastructure of the Counties, such as pumping of wells or land use regulations within the Middle Rio Grande watershed.

Villages, Towns, and Cities

Middle Rio Grande villages, towns, and cities are served by municipal and industrial water systems. While most use groundwater exclusively, Santa Fe also uses surface water supplies. Both Albuquerque and Santa Fe plan to use surface water directly from the San Juan-Chama Project, in addition to ground water. If future groundwater pumping or use of surface water depletes the river, the New Mexico State Engineer requires that these depletions be offset, either by acquiring other water rights, or with San Juan-Chama Project water. San Juan-Chama Project water contractors, including Albuquerque, Santa Fe, Bernalillo, Los Lunas, Taos, and Belen, call for water from Heron Reservoir to be delivered to the river. Many of these contractors have voluntarily entered into annual lease programs with Reclamation to enhance Middle Rio Grande valley water management. Municipalities also manage wastewater treatment systems that discharge into the Rio Grande.

Pursuant to Federal law and the prior appropriation doctrine, the Service recognizes that who depletes and the amount they deplete may vary from year to year. Consequently, the action agencies and non-Federal water users assume the risk that the future development of senior water rights, including Indian Pueblo and Tribal water rights, may result in shortages of water to junior users. Nothing in this biological opinion precludes any new depletions that result from the exercise of senior Indian water rights within the action area. Based on this understanding, the Service believes that nothing in this biological opinion affects or impairs Indian Pueblo and Tribal trust resources within the Middle Rio Grande Basin.

Irrigation Interests

Irrigation interests include acequias, individual irrigators, ditches, and the MRGCD. The MRGCD operates the diversion dams of the Middle Rio Grande Project to deliver irrigation water to lands in the Middle valley, including areas on six Middle Rio Grande pueblos: Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia, and Isleta. Currently, the MRGCD operates Project works as an agent of the United States, with the exception of El Vado Dam, which is operated by Reclamation.

Federal actions

Army Corps of Engineers

The Corps is responsible for operation and maintenance of five flood control dams on the Rio Grande and its tributaries: Abiquiu, Cochiti, Galisteo, Jemez Canyon, and Platoro dams. These projects provide flood control, sediment control, water supply, recreation, and fish and wildlife conservation.

Platoro Dam is on the Conejos River about 80 miles above the confluence with the Rio Grande. The dam was completed in 1951 by Reclamation for irrigation storage and flood control. The operation and maintenance responsibility has been transferred to the Conejos Water Conservancy District by Reclamation. The Corps is responsible for administering the flood control regulation.

Abiquiu Dam and Reservoir are on the Rio Chama about 32 river miles upstream from its confluence with the Rio Grande. Abiquiu Reservoir operates for flood control, sediment retention and water supply. The reservoir's storage allocations include 77,000 af for sediment control and 502,000 af for flood control.

Cochiti Dam and Lake are located on the mainstem of the Rio Grande, about 50 miles north of Albuquerque and 25 miles southwest of Santa Fe. Cochiti Dam extends across the Canada de Cochiti and the Santa Fe River, tributaries of the Rio Grande draining from the east. The Flood Control Act of 1960 (PL 86-645) authorized the construction of Cochiti Dam for flood and sediment control on the mainstem Rio Grande. The reservoir's storage allocations include 105,000 af for sediment control and approximately 500,000 af for flood control. In 1964, PL 88-293 authorized the establishment of a permanent pool for the conservation and development of fish and wildlife resources and recreation purposes, as long as the water to fill and maintain the pool comes from outside the Rio Grande Basin.

Galisteo Dam is on Galisteo Creek, about 12 miles upstream of its confluence with the Rio Grande. Galisteo Creek enters the Rio Grande about eight miles downstream of Cochiti Dam. Galisteo Dam was authorized for flood and sediment control in the Middle Rio Grande valley. The reservoir's storage allocations include 10,200 af for sediment control and 79,600 af for flood control. Because the dam was constructed with uncontrolled outlet works, the reservoir passes all flood inflow up to approximately 5,000 cubic feet per second (cfs). Galisteo Reservoir is normally dry, with most inflows occurring in the summer months because of summer thunderstorm activity.

Jemez Canyon Dam and Reservoir is on the Jemez River, 2.8 miles upstream of its confluence with the Rio Grande. It is located in Sandoval County, about 5 miles northwest of Bernalillo. Jemez Canyon Dam regulates the Jemez River for flood and sediment control. The reservoir's storage allocations include 40,100 af for sediment control and 73,000 af for flood control.

Bureau of Reclamation

The Albuquerque Area Office of Reclamation is responsible for operation, maintenance, and/or oversight of Federal projects on the mainstem Rio Grande and its upper basin tributaries. These projects include the San Luis Valley Project-Closed Basin Division, the San Juan-Chama Project, and the Middle Rio Grande Project. The goals of these projects are to provide sediment control, water supply, recreation, and fish and wildlife enhancement.

Reclamation proposes to meet its contractual obligations by delivering water as requested by contractors and other water users of the San Juan-Chama Project and Middle Rio Grande Project. The following section describes the projects and facilities involving Reclamation's proposed actions on the Middle Rio Grande and Rio Chama.

Closed Basin Division, San Luis Valley Project

Reclamation determined that the Closed Basin Division, San Luis Valley Project is extremely limited in its ability to provide water for downstream purposes during the duration of this proposed action and does not affect any listed species.

San Juan-Chama Project

The San Juan-Chama Project allows diversion of Colorado River Basin water into the Rio Grande Basin of New Mexico. The original projections for the San Juan-Chama Project planned an ultimate diversion of 235,000 af per year, with an initial phase development to accommodate an average annual diversion of up to 110,000 af. Only the initial phase was authorized and constructed by Reclamation.

Reclamation proposes to deliver water to the following users at the contractor's request. None of the existing contracts expires within the next ten years.

Municipal, domestic, and industrial purposes:

City of Albuquerque	48,200 af
Jicarilla Apache Nation	6,500 af
City and County of Santa Fe	5,605 af
County of Los Alamos	1,200 af
City of Española	1,000 af
Town of Belen	500 af
Village of Los Lunas	400 af
Village of Taos	400 af
Town of Bernalillo	400 af
Town of Red River	60 af
Twining Water & Sanitation District	15 af
San Juan Pueblo	2,000 af

Allocated, but uncontracted, water currently identified for future Indian water rights settlements and or use:

Taos Area	2,990 af

Irrigation:

Middle Rio Grande Cons. District	20,900 af
Pojoaque Valley Irrigation District	1,030 af
Recreation:	
Corps - Cochiti Rec. Pool	Up to 5,000 af
Total Allocation	**96,200 af**

On July 2, 2002, Article VII of the Rio Grande Compact became effective because the amount of Usable Water in storage in Elephant Butte and Caballo Reservoirs (Rio Grande Project storage) fell below 400,000 af. Article VII of the Compact prohibits increasing storage of native Rio Grande water in reservoirs built after 1929 in New Mexico until the Usable Water in Rio Grande Project storage is 400,000 af or greater. This includes El Vado, Abiquiu, Cochiti, Nichols, McClure, and Jemez Canyon Reservoirs. However, Article XVI of the Compact states that, "Nothing in this Compact shall be construed as affecting the obligations of the United States of America to Mexico under existing treaties, or to the Indian Tribes, or as impairing the rights of the Indian Tribes."

With Article VII Rio Grande Compact restrictions in place, only water for the six Middle Rio Grande Pueblos will be stored at El Vado Reservoir. Due to physical constraints at El Vado Dam, there is a range of releases that cannot be made at the facility. This range is approximately 15 to 50 cfs and varies depending on reservoir elevation. In order to ensure adequate storage for six Middle Rio Grande Pueblos needs, releases from Heron Reservoir (i.e., contract deliveries) will be adjusted to ensure native flows are stored at El Vado for those needs. At times, such operations will lead to flows on the Rio Chama well outside the recommendations of the Rio Chama Instream Flow Assessment, and it is likely that releases below El Vado Dam could occasionally cease completely to ensure such storage.

Proposed Discretionary Action

Reclamation proposes to operate Heron Reservoir within the following hydrological constraints:

- Meet contract obligations within the San Juan-Chama Project firm yield to contractors listed above, consistent with calls from contractors regarding timing and volume of releases
- Maximize storage to the extent available to provide sufficient water to fulfill contracts in current year and out-years
- Do not exceed safe storage amount of approximately 401,000 af
- Request temporary waivers from contractors to modify the date of their water delivery into the following calendar year, if such waivers will benefit the United States (i.e., to provide improved overall management of upstream water supplies)

- Dispose of contractor water if not called for by the contracted delivery date and where consistent with the terms of the contracts or if uncontracted water within the firm yield is available

Pojoaque Tributary Unit

The Pojoaque Tributary Unit is a component of the San Juan-Chama Project, and provides supplemental water (1,030 af) for approximately 2,768 acres of irrigated land, of which Indian lands comprise approximately 34 percent of the total. The storage feature of the Pojoaque Tributary Unit is Nambe Falls Dam and Reservoir located on the Rio Nambe. It is a concrete and earth embankment structure which forms a reservoir of 2,020 af capacity. The operation and maintenance of Nambe Falls Dam and Reservoir is performed by the Pojoaque Valley Irrigation District. Reclamation maintains oversight responsibilities for this work. Water that is physically stored in the reservoir is native to the Rio Grande Basin.

Proposed Discretionary Action

- Reclamation releases San Juan-Chama water from Heron Reservoir to offset storage effects at Nambe Falls Reservoir. Reclamation has some discretion over the timing of the releases within hydrological constraints
- Water is released in compliance with the Rio Grande Compact and in conjunction with other San Juan-Chama Project water management

Middle Rio Grande Project

Built originally by the MRGCD in the 1930's, Middle Rio Grande irrigation structures are used to divert and deliver water to the MRGCD customers' lands, including 21,664 acres of Indian water right lands within the MRGCD's service area. The Department of the Interior determined that the United States obtained title to all of the Middle Rio Grande Project works, as described in a 1947 Project Plan approved by Federal legislation and a subsequent 1951 contract between Reclamation and MRGCD. The MRGCD operates the Cochiti heading and Angostura, Isleta, and San Acacia diversion dams as "transferred works" under the 1951 contract, acting as the United States' agent. Reclamation operates El Vado Dam and Reservoir as "reserved works" at the MRGCD's direction, where the MRGCD pays in advance for that operation and maintenance under existing agreements.

Under the 1951 contract, Reclamation retains discretion to take back operation and maintenance of transferred works upon notice to the MRGCD. Reclamation states that it did not retain discretion over the day-to-day operations decisions at the facilities.

The release from storage, delivery of, and diversion of water for the six Middle Rio Grande Pueblos is part of this proposed action. The six Middle Rio Grande Pueblos can receive their water after October 31 of each year, delivered primarily through Middle Rio Grande Project facilities.

El Vado Dam and Reservoir

Reclamation operates El Vado Dam and Reservoir primarily for domestic, irrigation, and municipal uses in the Middle Rio Grande Project and for Indian lands in the Project area.

Proposed Discretionary Action

Operate and maintain El Vado Dam and Reservoir as directed by the MRGCD within the following hydrological constraints:

- Meet water user delivery requirements and MRGCD calls for water
- Maintain safe storage amount no higher than 6,896.20' by June 1 except under specific exceptions that consider flood routing criteria, water surface elevation, and river flow in the Middle Rio Grande valley
- Exercise United States right to store natural flows as needed for the six Middle Rio Grande Pueblos and for the MRGCD when Article VII of the Rio Grande Compact is not in effect
- Exercise United States storage right to store San Juan-Chama water if requested by the MRGCD
- Store and release water for the six Middle Rio Grande Pueblos

Diversion Dams

The MRGCD built Cochiti, Isleta, San Acacia, and Angostura diversion dams in the 1930s. The MRGCD constructed the Isleta Diversion Dam on Pueblo of Isleta lands. Pursuant to the Middle Rio Grande Project authorization, Reclamation rehabilitated Isleta Diversion Dam in 1955, San Acacia Diversion Dam in 1957, and Angostura in 1958. Cochiti Diversion Dam was inundated by Cochiti Dam and its outlet works in 1975. The Sile and Cochiti Eastside Canal collectively make up the Cochiti Heading, which takes water directly out of the upper stilling basin of the Cochiti Dam outlet works.

Proposed Discretionary Action

Allow the MRGCD to continue to operate and maintain diversion dams as agent of United States. Water for the six Middle Rio Grande Pueblos will be delivered primarily through Middle Rio Grande Project facilities.

Low Flow Conveyance Channel

Reclamation operates the Low Flow Conveyance Channel (LFCC) in conjunction with its supplemental water management program. In response to drought conditions in 1996, Reclamation began operating an outfall from the LFCC to the river near Escondida, New Mexico, to return about 10 cubic feet per second (cfs) to the Rio Grande. This outfall will continue to be used, as needed, to augment Rio Grande flow.

The only other water operation action that Reclamation currently performs on the LFCC is in response to requests by the MRGCD or the Bosque del Apache National Wildlife Refuge (Refuge) to check up flows in the channel at existing check structures, thus increasing the head on the water so that diversions can more easily be made. Such requests occur about one to three times during an irrigation season.

Proposed Discretionary Actions

- In response to requests by the MRGCD and Refuge, adjust gates in existing check structures to increase the head on the water in the LFCC
- Maintain the LFCC temporary outfall and other potential returns to the river

River Maintenance Program

Through the river maintenance planning process, Reclamation evaluates a wide range of alternatives to determine the best combination of activities that provide for the effective transport of water and sediment and the protection of riverside facilities. The activities must also be compatible with Rio Grande geomorphology to the maximum extent possible. Reclamation is also currently in the process of evaluating both in the laboratory and through field scale testing, various river bioengineering technologies to meet the previously mentioned objectives.
The primary objectives of evaluating Reclamation's river maintenance program through this BA are to develop sideboards for the types of river maintenance activities to be considered and the level of effects expected thereby streamlining the consultation process for individual projects. Appendix C contains a detailed description of the river maintenance program, updated from the

June 2001 BA, including related activities such as river maintenance techniques, bioengineering, sediment removal, vegetation management, levee maintenance, and reach-specific activities. It is also anticipated that this consultation will significantly reduce consultation efforts for future river maintenance projects. The Coordination Process subsection in the 2001 BA is incorporated by reference and outlines information and reports that will be developed as a part of the aforementioned coordination process and an environmental compliance document that will summarize activities associated with a project and document that the project falls within the sideboards established in this consultation. This streamlined process for specific projects should reduce the workload and time needed for future ESA compliance. Some activities that are defined and analyzed in the assessment with sufficient detail may not require future consultation. Projects that include significant actions not considered in this assessment or potentially significant adverse impacts to federally listed species will be consulted on separately. However, it is anticipated that the majority of river maintenance projects would fall within the sideboards.

Proposed Discretionary Action

Maintenance of the river channel for the Middle Rio Grande Project from Velarde, N. M. to Caballo Dam.

State of New Mexico Cooperative Program

Reclamation performs annual construction and maintenance work under contract with the State of New Mexico (State). In the past this work has included some river maintenance on the Rio Chama, maintenance of Drain Unit 7, drain and canal maintenance within the Bosque del Apache National Wildlife Refuge, and similar work at the state refuges at Bernardo and La Jolla. These activities are not a component of the aforementioned San Luis Valley, San Juan-Chama, or Middle Rio Grande projects.

Annual Operating Plan

Each year, Reclamation, in cooperation with the Corps, prepares and distributes to interested parties an Annual Operating Plan (AOP) to address water operations in the Rio Grande Basin, including operations related to the San Juan-Chama and Middle Rio Grande Projects. This document contains stream flow forecasts, including snowmelt runoff forecasts, anticipated operations outlooks for the various Reclamation and Corps-operated facilities along the river, and hydrographs reflecting reservoir operations, including actual (to the date of the plans publication) and anticipated inflow, outflow, and storage. Much of the planning information in the report is developed through the coordination, cooperation, and agreement of various parties. The agencies provide monthly updates, informing interested parties of operations throughout the course of the water year.

II. Status of the Species

Rio Grande Silvery Minnow

Species Description

The silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (U.S. Fish and Wildlife Service 1994). The species is listed by the State of New Mexico as an endangered species. Primary reasons for listing the silvery minnow involved a number of factors, described in the Status and Distribution section (e), that contributed to a collapse of population numbers throughout its historic range. The final recovery plan for the silvery minnow was released in July 1999 (U.S. Fish and Wildlife Service 1999c). The primary objectives are to increase numbers of the silvery minnow, enhance its habitat in the Middle Rio Grande valley, and expand its range by reestablishing the species in at least three other areas in its historic range.

The silvery minnow is a stout minnow, with moderately small eyes, a small, subterminal mouth, and a pointed snout that projects beyond the upper lip (Sublette *et al.* 1990). The back and upper sides of the silvery minnow are silvery to olive, the broad mid-dorsal stripe is greenish, and the lower sides and abdomen are silver. Maximum length attained is about 3.5 inches (90 mm). The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1994).

The silvery minnow has had an unstable taxonomic history, and in the past was included with other species of the genus *Hybognathus* due to morphological similarities. Phenetic and phylogenetic analyses corroborate the hypothesis that it is a valid taxon, distinctive from other species of *Hybognathus* (Cook *et. al.* 1992, Bestgen and Propst 1994). It is now recognized as one of seven species in the genus *Hybognathus* in the United States and was formerly one of the most widespread and abundant minnow species in the Rio Grande basin of New Mexico, Texas, and Mexico (Pflieger 1980, Bestgen and Platania 1991). Currently, *Hybognathus amarus* is the only remaining endemic pelagic spawning minnow in the Middle Rio Grande. The speckled chub (*Extrarius aestivalus*), Rio Grande shiner (*Notropis jemezanus*), phantom shiner (*Notropis orca*), and bluntnose shiner (*Notropis simus simus*) have gone extinct or have been extirpated from the Middle Rio Grande (New Mexico Department of Game and Fish 1998b, Dudley and Platania 1999). Given the loss of the other four pelagic spawning endemic minnow species, it is reasonable to presume that this species would likely be the next fish to be extirpated (Dudley and Platania 1997).

Critical Habitat

Critical habitat was proposed for the silvery minnow on June 6, 2002 (67 FR 39206) and was finalized on February 19, 2003 (68 FR 8088). The designation in the Rio Grande extends from

Cochiti Dam, Sandoval County, New Mexico downstream to the utility line crossing the Rio Grande, a permanent identified landmark in Socorro County, New Mexico, a total of approximately 157 mi (252 km). The designation also includes the tributary Jemez River from Jemez Canyon Dam in New Mexico to the upstream boundary of Santa Ana Pueblo, which is not included. The critical habitat designation defines the lateral extent (width) as those areas bounded by existing levees or, in areas without levees, 300 feet (ft) (91.4 meters (m)) of riparian zone adjacent to each side of the bankfull stage of the Middle Rio Grande. The Pueblo lands of Santo Domingo, Santa Ana, Sandia, and Isleta within this area are not included in the critical habitat designation. Except for these areas, the final remaining portion of the silvery minnow's occupied range in the Middle Rio Grande in New Mexico is designated as critical habitat.

Some developed lands within the 300-ft (91.4-m) lateral extent are not considered critical habitat because they do not contain the primary constituent elements and they are not essential to the conservation of the silvery minnow. Lands located within the exterior boundaries of the critical habitat designation, but not considered critical habitat, include: developed flood control facilities; existing paved roads; bridges; parking lots; dikes; levees; diversion structures; railroad tracks; railroad trestles; water diversion and irrigation canals outside of natural stream channels; the low flow conveyance channel; active gravel pits; cultivated agricultural land; and residential, commercial, and industrial developments. These developed areas do not contain any of the primary constituent elements and do not provide habitat or biological features essential to the conservation of the silvery minnow. However, some activities in these areas, like activities in other areas not included within the designation (if Federally funded, authorized, or carried out), may affect the primary constituent elements of the critical habitat and, therefore, may be affected by the critical habitat designation, as discussed later in this conference opinion.

The Service determined the primary constituent elements of critical habitat for the silvery minnow based on studies on their habitat and population biology. The primary constituent elements of critical habitat for the silvery minnow include:

1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to the following: backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep with relatively little velocity compared to the rest of the channel), eddies (a pool with water moving opposite to that in the river channel), and runs (flowing water in the river channel without obstructions) of varying depth and velocity – all of which are necessary for each of the particular silvery minnow life-history stages in appropriate seasons (e.g., the silvery minnow requires habitat with sufficient flows from early spring (March) to early summer (June) to trigger spawning, flows in the summer (June) and fall (October) that do not increase prolonged periods of low or no flow, and a relatively constant winter flow (November through February));

2. The presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat (e.g., connected oxbows or braided channels) within unimpounded stretches of flowing water of sufficient length (i.e., river miles) that provide a variation of habitats with a wide range of depth and velocities;

3. Substrates of predominantly sand or silt; and

4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of greater than 1 ºC (35 ºF) and less than 30 ºC (85 ºF) and reduce degraded conditions (e.g., decreased dissolved oxygen, increased pH).

The primary constituent elements identified above provide for the physiological, behavioral, and ecological requirements of the silvery minnow. The first primary constituent element provides water of sufficient flows to reduce the formation of isolated pools. We conclude this element is essential to the conservation of the silvery minnow because the species cannot withstand permanent drying (loss of surface flow) of long stretches of river. Water is a necessary component for all silvery minnow life-history stages and provides for hydrologic connectivity to facilitate fish movement. The second primary constituent element provides habitat necessary for development and hatching of eggs and the survival of the silvery minnow from larvae to adult. Low-velocity habitat provides food, shelter, and sites for reproduction, which are essential for the survival and reproduction of silvery minnow. The third primary constituent element provides appropriate silt and sand substrates (Dudley and Platania 1997; Remshardt et al. 2001), which we and other scientists conclude are important in creating and maintaining appropriate habitat and life requisites such as food and cover. The final primary constituent element provides protection from degraded water quality conditions. We conclude that when water quality conditions degrade (e.g., water temperatures are too high, pH levels are too low, and dissolved oxygen concentrations are too low), silvery minnows will likely be injured or die.

The following analysis (i.e., the determination whether an action destroys or adversely modifies critical habitat) for this conference opinion will evaluate whether the loss, when added to the environmental baseline, is likely to appreciably diminish the capability of the critical habitat to satisfy essential requirements of the silvery minnow. In other words, activities that may destroy or adversely modify critical habitat include those that alter the primary constituent elements (defined above) to an extent that the value of the critical habitat unit for both the survival and recovery of the silvery minnow is appreciably reduced (50 CFR 402.02).

Life History

The silvery minnow travels in schools and tolerates a wide range of habitats (Sublette *et al.* 1990), but generally prefers low velocity (less than 0.33 feet per second, 10 centimeters/second [cm/sec]) areas over silt or sand substrate that are associated with shallow (less than 15.8 inches [40 cm]) braided runs, backwaters or isolated pools (Bestgen and Platania 1991, Platania and Dudley 1997).

Adults are most commonly found in shallow and braided runs over sand substrate; whereas, young-of-year (YOY) occupy shallow, low velocity backwaters with sand-silt substrates (Bestgen and Platania 1991, Platania and Dudley 1997, Dudley and Platania 1997). Young-of-year and adults are seldom found concurrently in the same habitat. A study conducted between 1994 and 1996 characterized habitat availability and use at two sites in the Middle Rio Grande at Rio Rancho and Socorro (Dudley and Platania 1997). Dudley and Platania (1997) reported that this fish species was most commonly found in habitats with depths less than 7.9 inches (20 cm) or between 12.2 to 15.8 inches (31 to 40 cm), and were not found in habitats with water depths greater than 19.7 inches (50 cm). Over 85 percent were collected from low velocity habitats (less than 0.33 feet/sec [10 cm/sec]) (Dudley and Platania 1997, Watts et al. 2002). Habitat for the silvery minnow includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Areas with detritus and algal-covered substrates are preferred. The lee sides of islands and debris piles often serve as good habitat. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by the silvery minnow (Sublette *et. al.* 1990, Bestgen and Platania 1991).

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995, Platania and Altenbach 1998). Adults spawn in about a one-month period in late spring to early summer (May to June) in response to spring runoff. In 1997, Smith (1999) collected the highest number of eggs in mid-May, with lower frequency of eggs being collected in late May and June. These data suggest multiple spawning events and it appears likely that the silvery minnow spawns multiple times during the summer, perhaps concurrently with flow spikes. An artificial flow spike of 1,800 cfs (51 cubic meters/second) for 24 hours was released from Cochiti Dam on May 19, 1996. This flow spike apparently stimulated a spawning event and resulted in the collection of 49 silvery minnow eggs by researchers at Albuquerque on May 22, the day after the spike passed (Platania and Hoagstrom 1996). A late spawn was documented in the Isleta and San Acacia Reaches on July 24, 25, and 26, 2002, following a high flow event produced by a thunderstorm. This spawn was smaller than the typical spawning event in May, but a significant number of eggs were collected (N = 496) in two hours of effort (J. Smith, NMESFO, pers. comm. 2002). In 2002, small spawning events of a few eggs have been documented in all reaches except the Cochiti Reach as late as August 7 (J. Smith, NMESFO, pers. comm. 2002).

Platania (1995, 2000) found that development and hatching of eggs are correlated with water temperature. Eggs of the silvery minnow raised in 30°C water hatched in about 24 hours while eggs reared in 20 – 24°C water hatched within 50 hours. Eggs were 0.06 inches (1.6 millimeters [mm]) in size upon fertilization, but quickly swelled to 0.12 inches (3 mm). Recently hatched larval fish are about 0.15 inches (3.7 mm) in standard length and grow about 0.005 inches (0.15 mm) in size per day during the larval stages. Eggs and larvae can remain in the drift for 3-5 days, and may be transported from 134 to 223 miles (216 to 359 km) downstream depending on river flows. About three days after hatching the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. Young-of-year attain lengths of 1.5 to 1.6 inches (39 to 41 mm) by late autumn. Age 1 fish are 1.8 to 1.9 inches (45 to 49 mm) by the start of the spawning season. Most growth occurs between June (post spawning) and October, but there is some growth in the winter months. Maximum longevity is about 25 months, but very few survive more than 13 months. Captive fish have lived until Age 4**.**

Platania (1995) indicated that historically the downstream transport of eggs and larvae of the silvery minnow over long distances was beneficial to the survival of their populations. This behavior may have promoted recolonization of reaches impacted during periods of natural drought (Platania 1995). The spawning strategy of releasing floating eggs allows the silvery minnow to replenish populations downstream, but the current presence of diversion dams (Angostura, Isleta, and San Acacia Diversion Dams) prevents recolonization of upstream habitats (Platania 1995). As populations are depleted upstream, and diversion structures prevent upstream movements, isolated extirpations of the species through fragmentation may occur. Adults, eggs and larvae are also transported downstream to Elephant Butte Reservoir. It is believed that none of these fish survive because of poor habitat and predation from reservoir fishes.

The silvery minnow is herbivorous (feeding primarily on algae); this is indicated indirectly by the elongated and coiled gastrointestinal tract (Sublette *et al.* 1990). Additionally, detritus, including sand and silt, is filtered from the bottom (Sublette *et al.* 1990, Bestgen and Platania 1991).

Population Dynamics

The majority of spawning silvery minnows are one year old. Two year old fish comprise less than 10 percent of the spawning population. High silvery minnow mortality occurs during or subsequent to spawning, consequently very few adults are found in late summer. By December, the majority (>98 percent) of individuals are YOY (Age 0). This population ratio does not change appreciably between January and June, as Age I fish usually constitute over 95 percent of the population just prior to spawning. Generally, the population consists of only two age classes.

Platania (1995) found that a single female in captivity could broadcast 3,000 eggs in eight hours. Females produce 3 to 18 clutches of eggs in a 12-hour period. The mean number of eggs in a clutch is approximately 270. In captivity, silvery minnows have been induced to spawn as many as four times in a year (C. Altenbach, Albuquerque Biological Park, pers.comm. 2000). It is not known if they spawn multiple times in the wild. The high reproductive potential of this fish appears to be one of the primary reasons that it has not been extirpated from the Middle Rio Grande. However, the short life span of the silvery minnow increases the population instability. If a sufficient level of successful reproduction does not occur for two or more successive years, the species may not survive.

Density of silvery minnows increases from upstream (Angostura Reach) to downstream (San Acacia Reach). This is a result of the silvery minnow eggs and larvae being carried downstream in the current and the inability of the adults to repopulate upstream reaches because the diversion dams are barriers. This distributional pattern has been observed since 1994 (Dudley and Platania 2002) (Appendix D, Figure 3). The silvery minnow population has been declining since 1986, and has dropped precipitously since 1999 (Bestgen and Platania 1991, Platania 1993, Platania and Dudley 1997, Dudley and Platania 2002) (Appendix D, Figure 2). There was a slight increase in the number of silvery minnows caught in 2001; however, any gains made that year appear to have been lost in 2002. Drying of the Rio Grande has led to extensive losses of silvery minnow, especially in the San Acacia Reach where they were once most abundant (Dudley and Platania 2002) (Appendix D, Figure 3, Figure 4). The effect of river drying is evident in the months of June and July, 2002. In June, an abnormally high catch rate occurred because fish were trapped in small, isolated pools that were easy to seine. By July these pools were dry and no fish were present at these sites. The total number of fish caught for the remainder of 2002 remained low. In October, November, and December 2002, a total of 11, 36, and 15 silvery minnows, respectively, were caught from the 20 sites that are sampled regularly. The total area seined in these months ranged from 13,248 m^2 (3.3 acres) to 14,205 m^2 (3.5 acres) (calculated from data present on website http://www.uc.usbr.gov/progact/rg/rgsm2002/).

Although only limited data are available it appears that natural recruitment and survival of YOY in 2002, was very poor when compared to 2000, and 2001. From August 27 to 30, 2002, a total of 14 silvery minnow YOY was caught from 20 sites. For the same time period in August 2001, 714 silvery minnow YOY were caught from 19 sites. In 2000, 206 YOY were caught in early August from 15 sites and 31 YOY were caught from 13 sites in late August (calculated from data present on website http://www.uc.usbr.gov/progact/rg/rgsm2002/). The number os YOY caught in October of 2000, 2001, and 2002 were 74, 112, and 7, respectively (calculated from data present on website http://www.uc.usbr.gov/progact/rg/rgsm2002/).. Numbers of YOY from the October sampling period represent those fish that survived through the summer and are likely to contribute to the spawning population in the spring. These numbers indicate that the number of wild (not hatchery raised) silvery minnows available for spawning in 2003, may be very low.

Status and Distribution

Historically the silvery minnow occurred in 2465 mi (3967 km) of rivers in New Mexico and Texas. They were known to have occurred from Española upstream from Cochiti Reservoir; in the downstream portions of the Chama and Jemez Rivers; throughout the Middle and Lower Rio Grande to the Gulf of Mexico; and in the Pecos River from Sumner Reservoir downstream to the confluence with the Rio Grande (Sublette *et al.* 1990, Bestgen and Platania 1991). The silvery minnow currently occurs in 170 miles (274 km) of the Rio Grande, from Cochiti Dam downstream to Elephant Butte Reservoir, comprising 7.1 percent of its historic range.

The construction of main stream dams, such as Cochiti Dam and irrigation diversion dams have contributed to the decline of the silvery minnow. The construction of Cochiti dam in particular has affected the silvery minnow and flycatcher by reducing the magnitude and frequency of flooding events that help to create and maintain habitat for both of the species. In addition, the construction of Cochiti Dam has resulted in changes to the degradation of silvery minnow habitat within the Cochiti Reach. Flow in the river at Cochiti Dam is now generally clear, cool, and free of sediment.

There is relatively little channel braiding, and areas with reduced velocity and sand or silt substrates are uncommon. Substrate immediately downstream of the dam is often armored cobble (rounded rock fragments generally 8 to 30 cm (3 to 12 inches) in diameter). Further downstream the riverbed is gravel with some sand material. Ephemeral tributaries including Galisteo Creek and Tonque Arroyo introduce sediment to the lower sections of this reach, and some of this is transported downstream with higher flows (USFWS 2001b; 1999). Recovering from the degradation imposed by Cochiti Dam, the Rio Grande gains sediment below Angostura and becomes a predominately sand bed river with low, sandy banks in the downstream portion of the reach. The construction of Cochiti Dam also created a barrier between silvery minnow populations. As recently as 1978, the silvery minnow was collected upstream of Cochiti Reservoir; however numerous surveys since 1983 suggest that the fish is now extirpated from this area (USFWS 1999).

Surveys indicate a continued decline of silvery minnows in the entire Middle Rio Grande (Bestgen and Platania 1991, Platania 1993, Platania and Dudley 1997, Dudley and Platania 2002). In 1997, it was estimated that 70 percent of the silvery minnow population was found in the reach below San Acacia Diversion Dam, the downstream most diversion dam (Dudley and Platania 1997). During surveys in 1999, over 98 percent of the silvery minnows captured were downstream of San Acacia Diversion Dam (Dudley and Platania 2002). This area represents 2.4 percent of the historical range. Surveys indicate a dramatic decline in the number of silvery minnow in this reach (Dudley and Platania 2002) (Appendix D, Figure 3, Figure 4). Although the San Acacia Reach still has the greatest number of fish caught in surveys, because of the marked decline in numbers caught in this lower reach in the past few years, the percent of the population found here currently is only slightly above the Isleta and Angostura Reaches. The reasons why more silvery minnow are typically caught in the San Acacia Reach are:

1. The species' reproductive strategy (buoyant eggs spawned during the spring and early summer high flows), resulting in downstream transport of eggs and larval fish;

2. Diversion dams that prevent the movement of mature fish into upstream reaches; and

3. Reduction in the amount of available habitat in the upstream reaches due to streambed degradation, reduction in side-channel habitat, and the narrowing and incising of the stream channel.

The silvery minnow was federally listed as endangered for the following reasons:

1. Regulation of stream waters, which has led to severe flow reductions, often to the point of dewatering extended lengths of stream channel;

2. Alteration of the natural hydrograph, which impacts the species by disrupting the environmental cues the fish receives for a variety of life functions, including spawning;

3. Both the stream flow reductions and other alterations of the natural hydrograph throughout the year can severely impact habitat availability and quality, including the temporal availability of habitats;

4. Actions such as channelization, bank stabilization, levee construction, and dredging result in both direct and indirect impacts to the silvery minnow and its habitat by severely disrupting natural fluvial processes throughout the floodplain;

5. Construction of diversion dams fragment the habitat and prevent upstream migration;

6. Introduction of nonnative fishes that directly compete with, and can totally replace the silvery minnow, as was the case in the Pecos River, where the species was totally replaced in a time frame of 10 years by its congener the plains minnow (*Hybognathus placitus*); and

7. Discharge of contaminants into the stream system from industrial, municipal, and agricultural sources also impact the species (U.S. Fish and Wildlife Service 1993b, 1994).

These reasons for listing continue to threaten the species throughout its currently occupied range in the Middle Rio Grande.

Southwestern Willow Flycatcher

Throughout this document, a number of terms are used to help describe flycatcher population biology. For clarification, we provide the following definitions: A "territory" is the area occupied by a single or pair of flycatchers throughout the breeding season. Territories are the unit of measurement used by the Service in determining population numbers. Flycatchers tend to cluster their territories; a flycatcher site may include clusters or only one territory.

Species Description

The flycatcher is a small grayish-green passerine bird (Family Tyrannidae) measuring approximately 5.75 inches. It has a grayish-green back and wings, whitish throat, light gray-olive breast, and pale yellowish belly. Two white wingbars are visible (juveniles have buffy wingbars). The eye ring is faint or absent. The upper mandible is dark, and the lower is light yellow grading to black at the tip. The song is a sneezy "fitz-bew" or a "fit-a-bew" and the call is a repeated "whitt".

The flycatcher is one of four currently recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993). It is a neotropical migrant that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Tudor 1994, Howell and Webb 1995). The historic breeding range of the flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

Listing and Critical Habitat

The flycatcher was listed as endangered without critical habitat designation on February 27, 1995 (USFWS 1995). Critical habitat was designated on July 22, 1997 (USFWS 1997a). A correction notice was published in the Federal Register on August 20, 1997, to clarify the lateral extent of the designation (USFWS 1997b).

On May 11, 2001, the 10th Circuit Court of Appeals set aside designated critical habitat in those states under the 10th Circuit's jurisdiction (New Mexico). The Service decided to set aside critical habitat designated for the flycatcher in all other states (California and Arizona) until the economic analysis could be re-assessed. On May 2, 2002, the Service sent out a scoping letter to over 800 interested parties requesting information in order to develop a critical habitat proposal.

A final recovery plan for the flycatcher was signed by the U.S. Fish and Wildlife Service's Southwest Region Director on August 30, 2002, and is expected to be available to the public in early 2003. The Recovery Plan describes the reasons for endangerment, current status of the flycatcher, addresses important recovery actions, includes detailed papers on management issues, and provides recovery goals.

Reasons for Endangerment

Declining flycatcher numbers have been attributed to loss, modification, and fragmentation of riparian breeding habitat, loss of wintering habitat, and brood parasitism by the brown-headed cowbird (Sogge *et al.* 1997, McCarthey *et al.* 1998). Habitat loss and degradation are caused by a variety of factors, including urban, recreational, and agricultural development; water diversion and groundwater pumping; channelization; dams; and livestock grazing. Fire is an increasing threat to willow flycatcher habitat (Paxton *et al.* 1996), especially in monotypic salt cedar vegetation (DeLoach 1991) and where water diversions and/or groundwater pumping desiccates riparian vegetation (Sogge *et al.* 1997). Flycatcher nests are parasitized by brown-headed cowbirds (*Molothrus ater*), which lay their eggs in the flycatcher nests. Feeding sites for cowbirds are enhanced by the presence of livestock and range improvements such as waters and corrals, agriculture, urban areas, golf courses, bird feeders, and trash areas. When these feeding areas are in close proximity to flycatcher breeding habitat, especially coupled with habitat fragmentation, cowbird parasitism of flycatcher nests may increase (Hanna 1928; Mayfield 1977a,b; Tibbitts *et al.* 1994).

Habitat

The flycatcher breeds in dense riparian habitats from sea level in California to approximately 8,500 feet in Arizona and southwestern Colorado. Historic egg/nest collections and species' descriptions throughout its range describe the flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, T. Huels *in litt.* 1993, San Diego Natural History Museum 1995). Currently, flycatchers primarily use Geyer willow, Goodding's willow, boxelder (*Acer negundo*), salt cedar (*Tamarix* sp.), Russian olive (*Elaeagnus angustifolio*), and live oak (*Quercus agrifolia*) for nesting. Other plant species less commonly used for nesting include: Buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the flycatcher: Monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge *et al.*1997).

Salt cedar is an important component of the flycatchers's nesting and foraging habitat in Arizona and other parts of the bird's range. In 2001 in Arizona, 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were built in a salt cedar tree (Smith *et al.* 2002). Along the Rio Grande in New Mexico, between 1999–2001, only about 12 percent of territories (n = 138) were found in vegetation dominated by salt cedar. However, almost half of all the nests found from 1999–2002 (n = 156) were in salt cedar (Reclamation 2003). Although the quality of salt cedar as nesting habitat for flycatchers has been debated, comparisons of reproductive performance (USFWS 2002) and physiological conditions (Owen and Sogge 2002) of flycatchers breeding in native and exotic vegetation has revealed no difference.

Open water, cienegas, marshy seeps, or saturated soil are typically in the vicinity of flycatcher territories and nests; flycatchers sometimes nest in areas where nesting substrates are in standing water (Maynard 1995; Sferra *et al.* 1995, 1997). However, hydrological conditions at a particular site can vary remarkably in the arid Southwest within a season and among years. At some locations, particularly during drier years, water or saturated soil is only present early in the breeding season (i.e., May and part of June). The complete absence of water or visibly saturated soil has been documented at several flycatcher sites where the river channel has been modified (e.g., creation of pilot channels), where modification of subsurface flows has occurred (e.g., agricultural runoff), or as a result of changes in river channel configuration after flood events (Spencer *et al.* 1996).

Flycatcher habitat can quickly change and vary in suitability, location, and occupancy over time (Finch and Stoleson 2000). Flycatcher nesting habitat comprised of willows can grow out of suitability; salt cedar habitat can develop from seeds to suitability in five years; heavy runoff can remove or reduce habitat suitability in a day; and river channels, floodplain width, location, and vegetation density may change over time. The development of flycatcher habitat is a dynamic process involving, maintenance, recycling, and regeneration of habitat. Due to its dynamic and cyclic nature, flycatcher "habitat" is often defined as either suitable or potential (USFWS 2002). Thus, areas other than occupied locations can be considered flycatcher "habitat" and are essential to the survival and recovery of the flycatcher (USFWS 2002).

Breeding Biology

Throughout its range the flycatcher arrives on breeding grounds in late April and May (Sogge and Tibbitts 1992; Sogge *et al.* 1993; Muiznieks *et al.* 1994; Sogge and Tibbitts 1994; Maynard 1995; Sferra *et al.* 1995, 1997). Nesting begins in late May to early June and young fledge from late June through mid-August (Willard 1912; Ligon 1961; Brown 1988a,b; Whitfield 1990; Sogge and Tibbitts 1992; Sogge *et al.* 1993; Muiznieks *et al.* 1994; Whitfield 1994; Maynard 1995). Flycatchers typically lay three to four eggs per clutch (range = 1 – 5). Eggs are laid at one-day intervals and are incubated by the female for approximately 12 days (Bent 1960, Walkinshaw 1966, McCabe 1991). Young fledge approximately 12 to 13 days after hatching (King 1955, Harrison 1979). Typically one brood is raised per year, but birds have been documented raising two broods during one season and re-nesting after a failure (Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Whitfield 1994, Whitfield and Strong 1995). The entire breeding cycle, from egg laying to fledging, is approximately 28 days.

Flycatcher nests are fairly small (3.2 inches tall and wide) and are commonly placed in a shrub or tree. Nests are open cup structures, and are typically placed in the fork of a branch. Nests have been found against the trunk of a shrub or tree (in monotypic salt cedar and mixed native broadleaf/salt cedar habitats) and on limbs as far away from the trunk as 10.8 feet (Spencer *et al.* 1996). Typical nest placement is in the fork of small-diameter (e.g., 0.4 in), vertical or nearly vertical branches (USFWS 2002). Occasionally, nests are placed in down-curving branches. Nest height varies considerably, from 1.6 to 60 feet, and may be related to height of nest plant, overall canopy height, and/or the height of the vegetation strata that contain small twigs and live growth (USFWS 2002). Most typically, nests are relatively low, 6.5 to 23 feet above ground (USFWS 2002). Flycatcher nests in box elder dominated habitats are highest at almost 60 feet (USFWS 2002).

The flycatcher is an insectivore, foraging in dense shrub and tree vegetation along rivers, streams, and other wetlands. The bird typically perches on a branch and makes short direct flights, or sallies to capture flying insects. Drost *et al.* (1998) found the major prey items of the flycatcher (in Arizona and Colorado) consisted of true flies (Diptera); ants, bees, and wasps (Hymenoptera); and true bugs (Hemiptera). Other insect prey taxa included leafhoppers (Homoptera: Cicadellidae); dragonflies and damselflies (Odonata); and caterpillars (Lepidoptera larvae). Non-insect prey included spiders (Araneae), sowbugs (Isopoda), and fragments of plant material.

Brown-headed cowbird parasitism of flycatcher broods has been documented throughout its range (Brown 1988a,b; Whitfield 1990; Muiznieks *et al.* 1994; Whitfield 1994; Hull and Parker

1995; Maynard 1995; Sferra *et al.* 1995; Sogge 1995b). Where studied, high rates of cowbird parasitism have coincided with flycatcher population declines (Whitfield 1994; Sogge 1995a,c; Whitfield and Strong 1995) or, at a minimum, resulted in reduced or complete nesting failure at a site for a particular year (Muiznieks *et al.* 1994; Whitfield 1994; Maynard 1995; Sferra *et al.* 1995; Sogge 1995a,c; Whitfield and Strong 1995). Cowbird eggs hatch earlier than those of many passerine hosts, thus giving cowbird nestlings a competitive advantage (Bent 1960; McGeen 1972; Mayfield 1977a,b; Brittingham and Temple 1983). Flycatchers can attempt to renest, but this often results in reduced clutch sizes, delayed fledging, and reduced nest success (Whitfield 1994). Whitfield and Strong (1995) found that flycatcher nestlings fledged after July 20, had a significantly lower recruitment rate; cowbird parasitism was often the cause of delayed fledging.

Territory Size

Flycatcher territory size likely fluctuates with population density, habitat quality, and nesting stage. Territories are established within a larger patch of appropriate habitat sufficient to contain several nesting pairs of flycatchers; flycatchers appear to be semi-colonial nesters. Estimated territory sizes are 0.59 to 3.21 acres for monogamous males and 2.72 to 5.68 acres for polygynous males at the Kern River (Whitfield and Enos 1996), 0.15 to 0.49 acres for birds in a 1.48 to 2.22 acre patch of habitat on the Colorado River (Sogge 1995c), and 0.49 to 1.24 acres in a 3.71 acre patch on the Verde River (Sogge 1995a).

Movements

The site and patch fidelity, dispersal, and movement behavior of adult, nestling, breeding, non-breeding, and migratory flycatchers are just beginning to be understood (Kenwood and Paxton 2001, Koronkiewicz and Sogge 2001). From 1997–2000, 66 to 78 percent of flycatchers known to have survived from one breeding season to the next returned to the same breeding site and 22 to 34 percent of returning birds moved to different sites (Luff et al. 2000). In 2001, 75 percent of adults known to have survived from 2000 returned to the same breeding site (Kenwood and Paxton 2001). All but three surviving birds (n = 28) banded at Roosevelt Lake returned to the area the next year (Kenwood and Paxton 2001). Although flycatcher territory fidelity appears to be high, they can regularly move among sites within and between years (Kenwood and Paxton 2001). Within-drainage movements are more common than between-drainage movements (Kenwood and Paxton 2001). Year to year movements of birds have been detected between the San Pedro/Gila River confluence and Roosevelt Lake; the Verde River near Camp Verde and Roosevelt Lake; and the Little Colorado River near Greer and Roosevelt Lake (Kenwood and Paxton 2001). Typical distances moved range from 1.2 to 18 miles. However, long-distance movements of up to 137 miles have been observed on the lower Colorado River and Virgin River (McKernan and Braden 2001).

Rangewide Distribution and Abundance

Unitt (1987) documented the loss of more than 70 flycatcher breeding locations rangewide (peripheral and core drainages within its range), estimating the rangewide population at 500 to 1000 pairs. There are 221 known flycatcher breeding sites in California, Nevada, Arizona, Utah, New Mexico, and Colorado that were detected from 1993 – 2001. These include approximately 986 territories (Sogge *et al.* 2002, USFWS 2002) (Appendix E, Table 1). It is difficult to calculate the flycatcher abundance since not all sites are surveyed annually. Also, sampling errors (e.g., incomplete survey effort, double-counting males/females, composite tabulation methodology, natural population fluctuation, and random events) may bias population estimates and it is likely that the total breeding population of flycatchers fluctuates from year to year. Numbers have increased since the bird was listed and some habitat remains unsurveyed. However, after nearly a decade of intensive surveys, the existing numbers are consistent with the upper end of Unitt's (1987) estimate.

Flycatchers are believed to function as a group of meta-populations and their survival and recovery are dependent on well distributed populations in close proximity (USFWS 2002). Esler (2000) describes Levins' meta-population theory as addressing the demography of distinct populations (specifically extinction probabilities), interactions among sub-populations (dispersal and recolonization), and ultimately persistence of the aggregate of sub-populations, or the meta-population. Meta-population theory has been applied increasingly to species whose ranges have been fragmented. An incidence function analysis completed for the flycatcher incorporated a spatial component to estimate probabilities of habitat patch extinction and colonization (Lamberson *et al.* 2000). Modeling indicated that persistence of flycatcher populations is reduced when populations are small and widely distributed. Conversely, meta-populations are more stable when sub-populations are large and close together. However, where populations exceed 25 pairs, the effects of catastrophic events (e.g., fire, disease, flood, etc.) are magnified.

Rangewide, the population is comprised of extremely small, widely-separated breeding groups, including unmated individuals. About 40 to 50 percent of the 986 territories currently found throughout the subspecies range are located at three locations (Cliff/Gila Valley – NM, Roosevelt Lake – AZ, San Pedro/Gila confluence – AZ) (Appendix E, Table 1). In Arizona, 63 percent of the sites (n = 46) where flycatchers were found in 2001 (Smith *et al.* 2002) were comprised of 5 or fewer territories. In Arizona during the 2001 season, all but the "Salt River Inflow" site at Roosevelt Lake had 20 pairs or less (Smith *et al.* 2002). Rangewide, 76 percent of all sites from 1993 to 2001 had 5 or less flycatcher territories present at the site (Sogge *et al.* 2002). Across the bird's range, there are fewer than six sites with greater than 50 territories (Sogge *et al.* 2002). The distribution of breeding groups is highly fragmented. For example, in New Mexico the flycatchers at Los Ojos on the Rio Chama are approximately 60 miles from the closest known site at San Juan Pueblo, and the Radium Springs site is approximately 70 miles south of the flycatchers at San Marcial.

The large distances between flycatcher breeding groups and small population sizes decrease stability and increase the risk of local extirpation due to stochastic events, predation, cowbird parasitism, and other factors (USFWS 2002). Having 40 to 50 percent of the entire subspecies at just three locations could have dire effects on the species should catastrophic events occur that would remove or significantly reduce habitat suitability at those sites.

Additionally, flycatchers no longer occur at 65 of the 221 sites located and/or monitored rangewide since 1993 and all but two of these sites had less than 5 flycatcher territories present (Sogge *et al.* 2002). The two exceptions, PZ Ranch on San Pedro River (1996) and Colorado River Delta at Lake Mead (1996), were destroyed by fire and lake inundation, respectively.

New Mexico Distribution and Abundance

Unitt (1987) considered New Mexico as the state with the greatest number of southwestern willow flycatcher remaining. After reviewing the historic status of the flycatcher and its riparian habitat in New Mexico, Hubbard (1987) concluded, "[it] is virtually inescapable that a decrease has occurred in the population of breeding flycatchers in New Mexico over historic time. This is based on the fact that wooded sloughs and similar habitats have been widely eliminated along streams in New Mexico, largely as a result of the activities of man in the area." Unitt (1987), Hubbard (1987), and more recent survey efforts have documented very small numbers and/or extirpation in New Mexico on the San Juan River (San Juan County), near Zuni (McKinley County), Blue Water Creek (Cibola County), and the Rio Grande (Doña Ana County and Socorro County).

In New Mexico, surveys and monitoring since 1993 have documented approximately 173 to 400 flycatcher territories in 8 drainages (Appendix E, Table 2). Flycatchers have been observed at 34 sites along the Rio Grande, Chama, Canadian, Gila, San Francisco, San Juan, and Zuni drainages.

Within the Rio Grande, flycatchers were reported at Elephant Butte State Park in the 1970s; the majority nesting in salt cedar, although the exact location of the sightings was not reported (Hundertmark 1978, Hubbard 1987). In recent years, breeding pairs have been found within the Middle Rio Grande Project action area from Elephant Butte Reservoir upstream to the vicinity of Taos, on both the mainstem Rio Grande and on the Rio Grande de Rancho, a tributary to the upper Rio Grande. Breeding pairs have also been found on the Chama River in the vicinity of Los Ojos (Appendix E, Table 3).

Arizona Distribution and Abundance

Unitt (1987) concluded that "...probably the steepest decline in the population level of *E.t. extimus* has occurred in Arizona..." Historic records for Arizona indicate the former range of the flycatcher included portions of all major river systems (Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro) and major tributaries, such as the Little Colorado River and headwaters, and White River.

In 2001, 346 territories were known from 46 sites along 11 drainages in Arizona (Smith *et al.* 2001). The lowest elevation where territorial pairs were detected was 459 feet at Topock Marsh on the Lower Colorado River and the highest elevation was at the Greer River Reservoir (8202 feet).

As reported by Smith *et al.* (2002), the largest concentrations or breeding locations of willow flycatchers in Arizona in 2001 were at the Salt River and Tonto Creek inflows to Roosevelt Lake (255 flycatchers, 141 territories); near the San Pedro/Gila river confluence (219 flycatchers, 118 territories); Gila River, Safford area (46 flycatchers, 21 territories); Alamo Lake on the Bill Williams River (includes lower Santa Maria and Big Sandy river sites) (39 flycatchers, 21 territories); Topock Marsh on the Lower Colorado River (26 flycatchers, 14 territories); Lower Grand Canyon on the Colorado River (21 flycatchers, 12 territories); Big Sandy River Wikieup (14 flycatchers, 10 territories); and Alpine/Greer on the San Francisco River/Little Colorado River (5 flycatchers, 3 territories). The greatest number of flycatchers are found at two locations. Roosevelt Lake and the San Pedro/Gila confluence make up 259 (75 percent) of the 346 territories known in the state.

Only 68 (20 percent) of all known Arizona flycatcher territories in 2001 (40 on Gila River, 26 on Colorado River, 2 on Bill Williams River) were found below dams. Territories are primarily found on free-flowing streams or surrounding impoundments. At Roosevelt (n=141) and Alamo (n=21) lakes, due to the low reservoir levels, 162 territories (47 percent of statewide total) are found in the now dry lake bottom (Smith *et al.* 2002). Between 5 and 10 territories were discovered in 2002 in the conservation space of Horseshoe Reservoir on the Verde River (M. Ross, USFS, pers. comm.).

Following the 1996 breeding season, 145 territories were known to exist in Arizona. In 2001, 346 territories were detected; a statewide increase of 201 territories. Although there was an increase in statewide numbers, some sites became unoccupied or had reductions in number of territories, other new sites were detected, some sites grew in numbers, and better surveys provided more comprehensive information on actual abundance (Sogge *et al.* 2002). Since 1995, the increase of 184 territories (75 to 259) at Roosevelt Lake and at the San Pedro/Gila River confluence represents almost 90 percent of the statewide growth. Survey effort was initially a factor in detecting more birds at the San Pedro/Gila river confluence, but the Roosevelt population grew as a result of increased habitat development and bird reproduction in the conservation pool of the reservoir.

In 2002, drying of habitat and the subsequent decline of habitat suitability at Roosevelt Lake and other locations in Arizona (possibly as result of prolonged drought and water management) resulted in reductions in productivity and possible increases in cowbird parasitism and predation

(T. McCarthey, AGFD, pers. comm.). The combined loss of habitat suitability and productivity with the potential future inundation of habitat at Roosevelt Lake could negatively impact the status of the flycatcher in Arizona and possibly throughout the subspecies range (E. Paxton, USGS, pers. comm.).

California Distribution and Abundance

The historic range of flycatcher in California apparently included all lowland riparian areas in the southern third of the State. It was considered a common breeder where suitable habitat existed (Wheelock 1912, Grinnell and Miller 1944). Unitt (1984, 1987) concluded that it was once common in the Los Angeles basin, the San Bernardino/Riverside area, and San Diego County. Specimen and egg/nest collections confirm its former distribution in all coastal counties from San Diego County north to San Luis Obispo County, as well as in the inland counties (i.e., Kern, Inyo, Mohave, San Bernardino, and Imperial). Unitt (1987) documented that the flycatcher had been extirpated, or virtually extirpated (i.e., few territories remaining) from the Santa Clara River (Ventura County), Los Angeles River (Los Angeles County), Santa Ana River (Orange and Riverside counties), San Diego River (San Diego County), lower Colorado River (Imperial and Riverside counties and adjacent counties in Arizona), Owen's River (Inyo County), and the Mohave River (San Bernardino County). The flycatcher's former abundance in California is evident from the 72 egg and nest sets collected in Los Angeles County between 1890 and 1912, and from Herbert Brown's 34 nests and nine specimens taken in June of 1902 near Yuma.

Survey and monitoring efforts since the late 1980s have confirmed the flycatcher's presence at a minimum of 11 sites on 8 drainages in southern California (including the Colorado River). Current known flycatcher breeding sites are restricted to coastal southern California from Santa Barbara to San Diego, and California's Great Basin near the towns of Kernville, Bishop, Victorville, the San Bernardino Mountains and along the lower Colorado River. The largest populations exist along the San Luis Rey, Santa Margarita, Santa Ynez, and Kern and Owen's rivers. The total known flycatcher population in southern California is 95 territories, with the possibility for as many as 178 (M. Sogge, USGS, pers. com.).

Texas Distribution and Abundance

The Rio Grande and Pecos River in western Texas are considered the easternmost boundary for the flycatcher. Unitt (1987) found specimens from four locations in Brewster, Hudspeth (Rio Grande), and Loving (Pecos River) Counties where the subspecies is no longer believed to be present. Landowner permission to survey riparian areas on private property has not been obtained; thus current, systematic survey data are not available for Texas. There have been no other recent reports, anecdotal or incidental, of flycatcher breeding attempts in the portion of western Texas where the subspecies occurred historically. It is unknown at this time whether the flycatcher has been extirpated from Texas, but it is unlikely that there are significant numbers.

Nevada Distribution and Abundance

Unitt (1987) documented three locations in Clark County from which flycatchers had been found prior to, but not after 1970. In 1998, two pairs of flycatchers were documented. Current survey efforts have documented breeding birds along the Amargosa, Pahranagat, Muddy, and Virgin Rivers (McKernan and Braden 1997, 1998, 1999) in southern Nevada.

Colorado Distribution and Abundance

In 2002, 23 flycatcher territories were located in the San Luis Valley of the Rio Grande. Preliminary data on song dialects suggest that the few birds recently documented in southwestern Colorado may be the southwestern willow flycatcher. Surveys since 1993 have documented flycatchers at six locations in Delta, Mesa, and San Miguel Counties.

Utah Distribution and Abundance

Specimen data reveal that the flycatcher historically occurred in southern Utah along the Colorado River, San Juan River, Kanab Creek, Virgin River, and Santa Clara River (Unitt 1987). The flycatcher no longer occurs along the Colorado River in Glen Canyon, where Lake Powell inundated historically occupied habitat, nor in unflooded portions of Glen Canyon near Lee's Ferry where flycatchers were documented nesting in 1938. Similarly, recent surveys on the Virgin River and tributaries, and Kanab Creek have failed to document their presence (McDonald *et al.* 1995).

Fire

The evidence suggests that fire was not a primary disturbance factor in southwestern riparian areas near larger streams (USFWS 2002). Yet, in recent time, fire size and frequency has increased on the lower Colorado, Gila, Bill Williams, and Rio Grande rivers. The increase has been attributed to increasingly dry, fine fuels and ignition sources. The spread of the highly flammable plant, salt cedar, and drying of river areas due to river flow regulation, water diversion, lowering of groundwater tables, and other land practices is largely responsible for these fuels. A catastrophic fire in June of 1996, destroyed approximately a half mile of occupied salt cedar flycatcher habitat on the San Pedro River in Pinal County. That fire resulted in the forced dispersal or loss of up to eight pairs of flycatchers (Paxton *et al.* 1996). Recreationists cause over 95 percent of the fires on the lower Colorado River (USFWS 2002). Brothers (1984) attributed increased fire along the Owens River in California to increased use of the riparian zones by campers and fishermen in the past 30 years.

Mortality

There are no extensive records for the actual cause of flycatcher mortality. Incidents associated with nest failures, human disturbance, and nestlings are typically the most often recorded due to the static location of nestlings, eggs, and nests. As a result, nestling predation and brood parasitism are the most commonly recorded causes of flycatcher mortality. Human destruction of nesting habitat through bulldozing, groundwater pumping, and aerial defoliants has been recorded in Arizona (T. McCarthey, AGFD, pers. comm.) and New Mexico. Human collision with nests and spilling the eggs or young onto the ground have been documented near high use recreational areas (USFWS 2002). A flycatcher from the Greer Town site along the Little Colorado River in eastern Arizona, was found dead after being hit by a vehicle along SR 373. This route is adjacent to the breeding site (T. McCarthey, AGFD, pers. comm.).

<u>Reproductive Success</u>

In New Mexico, breeding success has been studied in the Gila River sites, and along the Rio Grande. In 2001, 133 nests were monitored in the Gila River near Gila-Cliff Valley, New Mexico. Data indicated that 34.4 percent of the nesting attempts were successful (Broadhead, et al, 2002). Along the Rio Grande in 2002, 80 nests were monitored and success was 55 percent (Reclamation 2002, unpublished data). In 2001, 45 nesting attempts were documented, and 73 percent of these were successful (Ahlers et al 2002). In 2000, the nest success along the Rio Grande was 65 percent of 26 monitored nests (Ahlers et al 2001). Nesting was usually initiated in May or early June, with the first eggs documented in the last week of May, and the latest egg laying in the last week of July (Reclamation 2003).

In 2001, a total of 426 nesting attempts were documented in Arizona at 40 sites (Smith *et al.* 2001). The outcome from 329 nesting attempts was determined (not every nesting attempt was monitored). Of the 329 nests monitored, 58 percent (n=191) were successful, 35 percent failed (n=114), and 7 percent (n=24) had an outcome which could not be determined. Causes of nest failure were predation (n=82), nest desertion (n=10), brood parasitism (n=6), infertile clutches (n=12), weather (n=2), and unknown causes (n=2). Cowbirds may have contributed to other abandoned nests, but no direct evidence was detected. Three parasitized nests fledged flycatchers along with cowbird young. Nine sites had cowbird trapping in 2001 (Alamo Lake, Greer/Alpine [Alpine Horse Pasture and Greer River Reservoir], Roosevelt Lake [Lake shore], and Winkelman [CB Crossing, Cook's Lake, Dudleyville Crossing, Indian Hills, and Kearny]).

Intensive nest monitoring efforts in California, Arizona, and New Mexico have shown that cowbird parasitism and/or predation can result in failure of the nest, reduced fecundity in subsequent nesting attempts, delayed fledging, and reduced survivorship of late-fledged young. Cowbirds have been documented at more than 90 percent of sites surveyed (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Camp Pendleton 1994, Muiznieks *et al.* 1994, Sogge and Tibbitts 1994, Whitfield 1994, Tomlinson 1997, Griffith and Griffith 1995, Holmgren and Collins 1995, Kus 1995, Maynard 1995, McDonald *et al.* 1995, Sferra *et al.* 1995, Sogge 1995a, b, San Diego Natural History Museum 1995, Stransky 1995, Whitfield and Strong 1995, Griffith and Griffith

1996, Skaggs 1996, Spencer *et al.* 1996, Whitfield and Enos 1996, Sferra *et al.* 1997, McCarthey *et al.*1998). The probability of a flycatcher successfully fledging its own young from a cowbird parasitized nest is low (less than 5 percent). Also, nest loss due to predation appears consistent from year to year and across sites, generally in the range of 30 to 50 percent. Documented predators of flycatcher nests identified to date include common king snake (*Lampropeltis getulus*), gopher snake (*Pituophis melanoleucos affinis*), Cooper's hawk (*Accipiter cooperii*), yellow-breasted chat (*Icteria virens*), and western screech owl (*Otus kennicottii*) (Paxton *et al.* 1997, McCarthey *et al.* 1998, Paradzick *et al.* 2000, Smith *et al.* 2002). These flycatcher predators were documented by video nest surveillance. Clark's spiny lizard (*Sceloporus clarkii*) and a spotted skunk (*Spilogale putorius*) were documented as predators of other nesting surrogate passerines. These limited, but thorough observations of nests, demonstrate a wide variety of flycatcher nest predators. It is expected that other common predators of passerines, such as grackles and cowbirds, also eat flycatcher eggs and nestlings.

Cowbird trapping has been demonstrated to be an effective management strategy for increasing reproductive success for the flycatcher in certain areas as well as for other endangered passerines (e.g., least Bell's vireo [*Vireo bellii pusillus*], black-capped vireo [*V. atricapillus*], golden-cheeked warbler [*Dendroica chrysoparia*]). It may also benefit juvenile survivorship by increasing the probability that parents fledge birds early in the season. Expansion of cowbird management programs may have the potential to not only increase reproductive output and juvenile survivorship at source populations, but also to potentially convert small, sink populations into breeding groups that contribute to population growth and expansion.

III. Environmental Baseline

One aspect of the environmental baseline applies to both the flycatcher and the silvery minnow; the current drought conditions. As of late January 2003, the state of New Mexico was experiencing drought conditions statewide affecting future spring runoff, soil moisture conditions, and streamflow outlooks. In early fall 2002, it was believed that precipitation events associated with a moderate El Niño would help relieve the drought pressures; however, these precipitation events never occurred (National Weather Service 2003a). The Rio Grande basin has received below normal precipitation, only adding to the long-term moisture deficits. The wet fall and early winter of 2002 provided some drought relief; however, long term moisture deficits averaging 9 inches over the past three years and deficits as high as 15 inches over the past 5 years contribute to current drought conditions in northern New Mexico, an area that supplies water to the Rio Grande basin (National Weather Service 2003a). In addition, Albuquerque experienced the warmest January in recorded history this year with only a small amount of measurable precipitation (National Weather Service 2003b). Even if New Mexico experiences a wet spring, an above-normal spring runoff is unlikely (National Weather Service 2003a).
The long-term moisture deficits have led to extremely low soil moisture conditions that will significantly decrease spring runoff (Natural Resources Conservation Service 2003a). Forecasts predict that streamflow in the Rio Grande will be 70 percent of normal into Cochiti Lake and 65

percent of normal into Elephant Butte Reservoir (National Weather Service and Natural Resources Conservation Service 2003, Natural Resources Conservation Service 2003a, 2003b). "At an expected 65 percent runoff prediction, it will take more than several years to restore the normal lake level of nearly one million acre feet or better in the [Elephant] Butte [Reservoir] (Natural Resources Conservation Service 2003a)." In Attachment C of the March 2002 Amendment to the Biological Assessment for the Rio Grande and Low Flow Conveyance Channel Modification, Reclamation states that it would take 25 years of 100 percent normal runoff to bring Elephant Butte Reservoir up to full capacity. On the other hand, it would take 3 years of 200 percent of normal runoff to achieve the same goal (Reclamation 2002).

Another aspect of the environmental baseline that also applies both to the silvery minnow and the flycatcher are the water rights of the Indian Pueblos. There are 18 federally-recognized Indian Pueblos in the action area: Taos, Picurís, San Juan, Santa Clara, San Ildefonso, Pojoaque, Nambé, Tesuque, Jemez, Zia, Acoma, Laguna, Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia, and Isleta. The Pueblos hold aboriginal, time immemorial, reserved, and in some instances contract water rights that are recognized and protected under Federal law. With respect to the six Middle Rio Grande Pueblos (Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia, and Isleta), a certain portion of their water rights is statutorily recognized under the ESA of March 13, 1928, 42 Stat. 312, and the Act of August 27, 1935, 49 Stat. 887. These Acts of Congress do not establish the full extent of the water to which these Pueblos are entitled. In addition, the Navajo Nation and certain Navajo allottees hold aboriginal, time immemorial, or reserved water rights within the action area.

The Jicarilla Apache Nation (Nation) has existing uses of water rights in the Rio Grande Basin, including rights under a Federal settlement contract and legislation, and a partial final decree in the Rio Chama adjudication. The Nation received a Congressionally authorized and approved perpetual contract for the diversion and depletion of 6,500 af per year of SJC Project water as part of the settlement of its water rights claims in 1992. The Nation became entitled to those rights in April 1999 when the conditions of the settlement contract were fulfilled. Beginning in 1997, this water has been consumptively used through exchanges with the MRGCD by Reclamation with the Nation's consent.

In the Rio Chama Basin, the Nation also has adjudicated water rights for historic and existing uses on Reservation lands. The Nation's reserved water rights for historic and existing uses total an annual diversion of 65.14 af or the quantity of water necessary to supply an annual depletion of 40.32 af, whichever is less, and a net evaporation of 1,786.85 af. The Nation's water rights for historic and existing uses perfected under state law and located within the lands proclaimed as part of the Reservation on September 13, 1988, total an annual diversion of 1,492.93 af or a quantity of water necessary to supply an annual depletion of 1,095.01 af, whichever is less, and a net evaporation of 765.74 af.

Rio Grande Silvery Minnow

Past actions have eliminated and severely altered habitat conditions for the silvery minnow. These actions can be broadly categorized as changes to the natural hydrology of the Rio Grande and changes to the morphology of the channel and floodplain. Other factors that influence the environmental baseline are water quality, the propagation of silvery minnows, on-going research efforts, and past projects in the Middle Rio Grande. Also of importance is the current drought, the expected weather pattern for the near future, and how it may affect flow in the Rio Grande. Each of these topics will be discussed.

Changes in Hydrology

There have been two primary changes in hydrology since the construction of dams on the Rio Chama and Rio Grande that affect the silvery minnow: loss of water and changes to magnitude and duration of peak flows.

Loss of Water

Prior to measurable human influence on the system, up to the fourteenth century, the Rio Grande was a perennially flowing, aggrading river with a shifting sand substrate (Biella and Chapman 1977). There is now strong evidence that the Middle Rio Grande first began drying up periodically after the development of Colorado's San Luis Valley in the mid to late 1800s (Scurlock 1998). After humans began exerting more influence on the river, there are two documented occasions when the river became intermittent; during prolonged, severe droughts in 1752 and 1861 (Scurlock 1998). The silvery minnow historically survived low-flow periods because such events were infrequent, of lesser magnitude than they are today, there were no diversion dams to block repopulation of upstream areas, the fish had a much greater geographical distribution, and there were oxbow lakes, cienegas, and sloughs that supported fish until the river became connected again.

Lack of water is the single most important limiting factor for the survival of the species. Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow. Agriculture accounts for 90 percent of the water consumption in the Middle Rio Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the MRGCD was 535,280 acre-feet (ac-ft)(65,839 hectare-meters) for the period from 1975 to 1989 (Reclamation 1993). In 1990, total water withdrawal (groundwater and surface water) from the Rio Grande Basin in New Mexico was 1,830,628 acre feet, significantly exceeding a sustainable rate (Schmandt 1993). Water withdrawals have not only reduced overall flow quantities, but also caused the river to become locally intermittent and/or dry for extended reaches. Irrigation diversions and drains significantly reduce water volumes in the river.

River reaches particularly susceptible to drying, as documented during the spring and summer of 1996 by the Service, are immediately downstream of the Isleta Diversion Dam (river mile 169), a

5-mile (8-km) reach near Tome (river miles 150-155), a 5-mile (8-km) reach near the U.S. Highway 60 Bridge (river miles 127-132), and an extended 36-mile (58-km) reach from near Brown Arroyo (downstream of Socorro) to Elephant Butte Reservoir. Massive fish kills, including tens of thousands of silvery minnows, have occurred in these lower reaches when the river has dried (Arritt 1996). In 1996, at least 36 river miles in the San Acacia Reach were dry for 128 days and the San Marcial Gauge, located at the lower end of this reach had 0 cfs reading for 180 days. In 1997, at least 16 river miles were dry for approximately five to seven days. Approximately 16 river miles were dry for 28 days in 1998. The river was dry in 1999 for four to five days for at least 28 river miles. Drying occurred in 2000 for less than a week in late July. Approximately 8 to 10 miles of river dried in 2001, with the period of intermittency usually lasting less than two days (U.S. Fish and Wildlife Service 2002). While some dead silvery minnows were collected during the shorter drying events, it is assumed that many more mortalities occurred than were documented.

Drying occurred during the 2002 irrigation season in the Isleta and San Acacia Reaches. Between June and August, 2002, approximately 15.75 miles of river in the San Acacia Reach and 11 miles in the Isleta Reach dried. These reaches of river dried and re-wetted several times due to rainstorm events. During these drying events, the Service's salvage crews captured and relocated 3,639 adult silvery minnows to the Angostura and Isleta Reaches, and documented 248 dead silvery minnows that count toward the Incidental Take Statement in the June 29, 2001, programmatic biological opinion, as clarified in an August 1, 2002, memo to Reclamation. Approximately 98 percent of the salvaged silvery minnows were released at Central Bridge in Albuquerque, with the remainder released in the upper portions of the Isleta Reach. Re-wetting from storm runoff and the subsequent drying of the river in areas that were previously dry led to the death of additional silvery minnows (<100). These silvery minnows were not considered as take under the June 29, 2001, programmatic biological opinion because an "act of nature" caused the river to re-wet and subsequently dry, rather than the actions of Federal agencies.

In 1996, the Service conducted an emergency salvage of silvery minnows trapped in drying pools downstream of Isleta Diversion. Approximately 10,000 silvery minnows were salvaged, transported, and released in a perennial reach of the Rio Grande near Albuquerque (Arritt 1996). Additional salvages of silvery minnows occurred between 1997 and 2002. Mortality of silvery minnows was documented in both 1996, 1997, and 1999 in specific isolated pools during river intermittency (Smith and Hoagstrom 1997, Smith 1999, Dudley and Platania 1999b). Smith and Hoagstrom (1997) and Smith (1999) focused on the relative size of the residual pools (i.e., estimated surface meters and maximum depth) in relation to pool longevity (i.e. number of days pool existed) and fish community. Smith (1999) found that the typical isolated pools found during intermittent conditions usually only lasted 48 hours. Those that persisted longer lost greater than 81 percent of their estimated surface area and more than 26 percent maximum depth in 48 hours. Because of poor water quality (high water temperatures, low dissolved oxygen) and exposure to predators, mortality of silvery minnows is expected when drying exceeds 48 hours. These small isolated pools are very different in character from the large, deep oxbow lakes and sloughs that once occurred along the river and sustained fish populations through times of drought.

During the past few years, the City of Albuquerque and other San Juan-Chama (SJC) project contractors allowed the use of their SJC water for the purpose of providing flows in the river that were crucial for the silvery minnow population in the San Acacia reach. Albuquerque intends to fully utilize its SJC water in the future for municipal uses; therefore, this water may not be available for future activities involving conservation of silvery minnow populations (John Stomp, City of Albuquerque, pers. comm. 1998).

Water in the active river channel has been reduced with the construction of drains along both banks of the Rio Grande. The majority of the Middle Rio Grande valley has drains paralleling the river. The west side of the Rio Grande has 160 miles (258 km) of drains, including the LFCC, in a 180-mile (290 km) stretch between Cochiti Dam and the Narrows at Elephant Butte Reservoir. This represents 89 percent of the total length between Cochiti Dam and Elephant Butte Reservoir. The east-side drains also parallel the river to San Acacia Diversion Dam for a distance of 100.5 miles (162 km).

The LFCC that parallels the river for 75 miles (121 km) was designed to expedite delivery of compact water to Elephant Butte Reservoir during low flow conditions. Water was diverted to the LFCC from the Rio Grande from 1959 to 1985. The LFCC has a capacity of approximately 2,000 cfs. Because the LFCC is at a lower elevation than the river bed, there is seepage from the river to the LFCC. This causes a significant loss of surface flows in the river channel. If the flow in the Rio Grande is 2,000 cfs or less, diverting water into the LFCC can dewater the river from the San Acacia Diversion Dam south to Elephant Butte Reservoir. The LFCC has not been fully operational since 1985, because of outfall problems at Elephant Butte Reservoir. In 1997, 1998, and 2001, experimental operations occurred in the upper 10 miles of the LFCC for sedimentation studies; however, the diverted flows were returned to the Rio Grande through a temporary outfall near Escondida. It is estimated that 67 percent of the flow in the Rio Grande is lost to seepage in the project area, with much of this water seeping into the LFCC (Jim Wilber, Reclamation, pers. comm. 1999).

In 2000, a program was initiated to pump water from the LFCC back into the river. The initial pumping program had a total of three stations in the San Acacia Reach. These pumps augmented flows throughout the reach within and below the Refuge. This program reduced the amount of intermittency in the river in 2000 and 2001. In 2002, the pumping was expanded to five stations located in the San Acacia Reach from about 3 miles upstream of US 380 to near Old Fort Craig. The pumping stations at the southern boundary of the Refuge and Fort Craig have created approximately 16 miles of flowing water. A new pumping station located approximately 4 miles north of the southern boundary of the Refuge will provide approximately 4 miles of additional flowing water when available in the LFCC. With these pumping stations, flow can be maintained for approximately 20 continuous miles of river, from near the middle of the Refuge, to Elephant

Butte. However, if the pumps fail, the river may become intermittent. Reclamation has contractors that check the pumps, but mechanical failures can go undiscovered for several hours. Unexpected disasters such as engine fires (one occurred in mid-July of 2002) can severely affect the ability of the pumps to deliver water (G. Pargas, Tetra Tech, pers. comm. 2002).

Changes to Size and Duration of Peak Flows

Water management has also resulted in a loss of peak flows that historically initiated spawning. The reproductive cycle of the silvery minnow is tied to the natural river hydrograph. A reduction in peak flows and/or improper timing of flows may inhibit reproduction. Lack of a peak flow was especially severe in the spring and summer of 1996 because of drought. The Service was concerned that silvery minnow reproduction might not occur or would be seriously reduced. A moderate flow spike was coordinated with the cooperation of the City of Albuquerque. River and habitat conditions prior, during, and following the spike were monitored. This spike was successful in triggering a spawn and temporarily improved habitat conditions (Platania and Hoagstrom 1996).

Again in the spring of 2002, there was concern that silvery minnows would not spawn because of a lack of spring runoff due to an extended drought. Runoff for the year was predicted to be the lowest in 100 years at around 2 percent of normal at San Marcial. Water was released (1650 cfs) from Cochiti Reservoir on May 14, 2002, to provide a cue for silvery minnow spawning. In response to the release, a significant spawning event occurred in all reaches except the Cochiti Reach.

In addition to providing a cue for spawning, flood flows also maintain a channel morphology to which the silvery minnow is adapted. The changes in channel morphology that have occurred from the loss of flood flows is discussed below.

Changes in Channel Morphology

Historically, the Rio Grande was sinuous, braided, and freely migrated across the floodplain. Changes in natural flow regimes, narrowing and deepening of the channel, and restraints to channel migration (i.e. jetty jacks) adversely affect the silvery minnow. These effects result directly from constraints placed on channel capacity by structures built in the floodplain. These environmental changes have and continue to degrade and eliminate spawning, nursery, feeding, resting, and refugia areas required for species survival and recovery (U.S. Fish and Wildlife Service 1993a).

The active river channel through the reaches where the minnow persists is being narrowed by the encroachment of vegetation, resulting from continued low flows and the lack of overbank flooding. The lack of flood flows has allowed non-native riparian vegetation such as salt cedar and Russian olive to become established along the river banks. These non-native plants are very resistant to erosion and encroach on the channel, resulting in it narrowing. When water is confined in a more narrow cross-section, its velocity increases, which gives it more power. Fine sediments such as silt and sand are carried away leaving coarser bed materials such as gravel and cobble. Habitat studies during the winter of 1995 and 1996 (Dudley and Platania 1996, Dudley and Platania 1997), demonstrated that a wide, braided river channel with low velocities resulted in higher catch rates of silvery minnows, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow are decreasing in the historically extensive range of the species. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow eggs, fry, and juveniles.

Where the silvery minnow now persists, human development and use of the floodplain have greatly restricted the width available to the active river channel. A comparison of river area between 1935 and 1989 shows a 52-percent reduction, from 26,598 acres (10,764 ha) to 13,901 acres (5,626 ha)(Crawford et al. 1993). These data refer to the Rio Grande from Cochiti Dam downstream to the "Narrows" in Elephant Butte Reservoir. Within the same stretch, 234.6 miles (378 km) of levees occur, including levees on both sides of the river. Analysis of aerial photography taken by Reclamation in February 1992, for the same river reach, shows that of the 180 miles (290 km) of river, only 1 mile (1.6 km), or 0.6 percent of the flood plain has remained undeveloped.

Development in the flood plain, makes it difficult, if not impossible, to send large quantities of water downstream that would create low velocity side channels that the silvery minnow prefers. For example, the railroad bridge at San Marcial is so low, flow releases from Cochiti Dam have been reduced to avoid damage to the bridge. The construction of houses in the flood plain on the east side of the river at Socorro requires that releases from Cochiti Dam are reduced to prevent damage to these homes. These reduced releases decrease the available habitat for the silvery minnow.

Water Quality

The term "water quality" is used to refer only to the chemical characteristics of the water column. However, the water quality of a river is reflected in the quality or condition of its associated natural resources (e.g., the water column, sediment, biota). The disadvantage of looking only at the physicochemical characteristics of the water is that they only provide a snapshot in time. Because of dilution and the constant downstream flow of water, significant changes in important water quality characteristics may not be detected because samples were taken too soon or too late or at an inappropriate site. This explains why the results of water quality tests are often highly variable over space and time. However, by examining the results of several studies and permit violations from wastewater treatment plants (WWTPs) bordering the Rio Grande we can gain some understanding of important factors that influence water quality and the health of aquatic organisms in the river.

Both point (pollution discharges from a pipe) and non-point (diffuse sources of pollution) sources affect the Middle Rio Grande. Major non-point sources include agricultural activities (e.g., fertilizer and pesticide application, water diversion), stormwater run off, mining activities, livestock grazing, and feedlots. Major point sources of pollution are WWTPs.

Effluents from WWTPs contain contaminants that may affect the water quality of the river. It is anticipated that WWTP effluent may be the primary source of permanent water during extended periods of intermittency in 2003. For that reason the water quality of the effluent is extremely important. In the project area, the largest WWTP discharges are from Rio Rancho, Bernallilo, Albuquerque, and Los Lunas. Records of effluent discharge are readily available for the Albuquerque WWTP for the time period since 1998. Since that time, chlorine and ammonia have been discharged at levels lethal to silvery minnow. On November 30, 1999, 490 parts per billion (PPB) were released (11 ppb is lethal to fish). On July 31, 2001, 14 milligrams/liter (mg/L) of ammonia were released. LC50 is the concentration of a contaminant at which 50 percent of the fish die. Buhl (2002) found that the LC 50 for ammonia for silvery minnow was 13.9 mg/L.

Although we do not have complete records for the other WWTPs, in the summer of 2000, Rio Rancho WWTP #3 released approximately one million gallons of raw sewage into the Rio Grande. Chlorine treatment was maximized in an attempt to reduce the public health risk. Total ammonia, as measured as nitrogen, was reported as 37 mg/L on July 13, 2000, and as 17.1 mg/L on July 27, 2000. No violations of either chlorine or ammonia standards were recorded. This suggests that the averaging of measurements and/or the frequency of water quality measurements is insufficient to detect water quality situations that would be toxic to silvery minnow. Rio Rancho WWTP now uses ultraviolet disinfection so the release of chlorine should no longer occur. However, high ammonia levels could still be discharged.

In addition to chlorinated residuals and ammonia, WWTP effluents may also include cyanide, chloroform, organophosphate pesticides, semi-volatile compounds, volatile compounds, heavy metals, and pharmaceuticals and their derivatives, which can pose a health risk to silvery minnow when discharged in concentrations that exceed the protective water quality standards (J. Lusk *in litt*. 2003). Even if the concentration of a single element or compound is not harmful by itself, chemical mixtures may be more than additive in their toxicity to silvery minnow (Buhl 2002). In the wild, silvery minnow are exposed to many different chemical and physical agents simultaneously, and these can not be accounted for during traditional water quality sampling regimes. The long-term effects and overall impacts of chemicals on the silvery minnow are not known.

As precipitation falls and exceeds the ability of soils and plants to absorb it, the remainder of the water runs off, usually in a short-lived flood. Large precipitation events wash sediments and pollutants into the river from surrounding lands, through storm drains and intermittent tributaries.

Although there are contaminant monitoring programs required for stormwater outfalls, there are no criteria established to regulate the quality of stormwater discharges. Contaminants of concern to the silvery minnow are the metals aluminum, cadmium, lead, mercury, and zinc, organics such as oils, the industrial solvents trichloroethene and tetracholoroethene, and the gasoline additive methyl tert-butyl ether.

Harwood (1995) studied the North Floodway Channel (Floodway) of Albuquerque, which drains an urban area of about 90 square miles and crosses Pueblo of Sandia lands. He found that storm water contributions of dissolved lead, zinc, and aluminum were significant and posed a threat to the water quality of the Rio Grande. Because the Floodway crosses lands of the Pueblo of Sandia and enters their portion of the Rio Grande, the Pueblo requested that the Environmental Protection Agency conduct toxicity tests on water in the Rio Grande collected below the Floodway. Crustaceans exposed to this water were found to have significant reproductive impairment and mortality as compared with controls. Additionally, larval fish also experienced significant mortality and/or narcosis when exposed to water and bed sediment collected from this same area on April 22, 2002 (USEPA Region 6, State/EPA Ambient Toxicity Monitoring Program - Results for New Mexico webpage, accessed February 6, 2003). This study indicates that stormwater runoff can impact the water quality of the Rio Grande and the aquatic organisms that live in the river.

Sediment is the sand, silt, organic matter, and clay portion of the river bed, or the same material suspended in the water column. Ong et al. (1991) recorded the concentrations of trace elements and organochlorine pesticides in suspended sediment and bed sediment samples collected from the Middle Rio Grande between 1978 and 1988. These data were compared to numerical sediment quality criteria (Probable Effects Criteria [PEC]) proposed by MacDonald et. al. (2000). According to MacDonald et al. (2000) most of the PECs provide an accurate basis for predicting sediment toxicity to aquatic life and a reliable basis for assessing sediment quality in freshwater ecosystems. Some concentrations of trace elements and organochlorine pesticides in suspended sediment collected from the Rio Grande floodway at San Acacia and San Marcial exceeded the PECs for copper, chromium, and zinc. The concentrations of trace elements and organochlorine pesticides in bed sediments were much lower than the PECs suggesting a differential adherence pattern to suspended sediments and bed sediments. Additional trace elements were elevated in suspended sediments collected from the Rio Grande at San Felipe. The concentrations of contaminants adhered to suspended sediments may pose a health risk to silvery minnow depending on ingestion rates, bioavailability, and the relative sensitivity of this species.

Volatile organic compounds that have been detectable in the Middle Rio Grande at Isleta include chlorpyrifos, and trichlorofluoromethane (Ellis et al. 1993). Anderholm et al. (1993) described the the relationship between the quality of shallow ground water and land use in an urban area in and adjacent to Albuquerque. Important sources of recharge that affect shallow ground-water quality in the area include infiltration of surface water, which is used in agricultural land-use areas to irrigate crops, and infiltration of septic-system effluent in residential areas. The presence of synthetic organic compounds (volatile organic compounds and pesticides) in shallow ground water in the study area indicated that human activities have affected shallow ground-water quality. Past spills of trichloroethylene and other toxic substances have polluted some of the groundwater in the Albuquerque area. The connection of the surface water quality to the shallow ground water and the exchange of volatile organic compounds is currently being investigated by U. S. Geological Survey (USGS).

Semi-volatile organic compounds are a large group of environmentally important organic compounds. Three groups of compounds, polycyclic aromatic hydrocarbons (PAHs), phenols, and phthalate esters, were included in the analysis of bed sediment collected by the USGS (Levings et al. 1998). These compounds were abundant in the environment, are toxic and often carcinogenic to organisms, and could represent a long-term source of contamination. The analysis of the PAH data by Levings et al. (1998) show one or more PAH compounds were detected at 14 sites along the Rio Grande. Four of these sites had about 60 percent of the detections; three sites had no detections. Two of the four sites are downstream from urban land-use areas, one is downstream from a mining area, and one is in a forested area. Phenol compounds were detected at 13 sites with 50 percent of the detections at five sites. Two sites had no detections. No relation to land use was apparent for the phenol compound detections. Four phthalate ester compounds were detected at ten sites. Only one site, downstream from an urban land use area, had detections of more than one phthalate ester. Polycyclic aromatic hydrocarbons and other semi-volatile compounds affect the sediment quality of the Rio Grande and may affect silvery minnow behavior, habitat, feeding, and health.

Pesticide contamination occurs from agriculture, as well as from the cumulative impact of residential and commercial landscaping activities. The presence of pesticides in surface water is erratic and depends on the amount applied, timing, location, and method of application. Water quality standards have not been set for many pesticides and existing standards do not consider cumulative effects of several pesticides in the water at the same time. Roy et al. (1992) reported that DDE, a degradation product of DDT, was detected most frequently in whole body fish collected throughout the Rio Grande. He suggested that fish in the lower Rio Grande may be accumulating DDE in concentrations that may be harmful to fish and their predators. In a study at Refuge, Ong et al. (1991) found detectable levels of DDE in coot and carp. Carter (1997) reported that sediment collected and analyzed in the Rio Grande had detectable concentrations of DDE, but that no other organochlorine insecticides or polychlorinated biphenyls were detected. Whole-body fish samples were also collected at the site of sediment collection and analyzed for organic compounds. Organic compounds were reported more frequently in samples of fish, and more types of organic compounds were found in whole-body fish samples than in bed-sediment samples. Concentrations of DDE, polychlorinated biphenyls, cis-chlordane, trans-chlordane, trans-nonachlor, and hexachlorobenzene were also detected in whole-body samples of fish. The presence of DDT and its metabolites, DDD and DDE, in bed sediment and whole-body fish confirms the persistence of this pesticide in the Rio Grande. Although DDT applications have stopped and concentrations in fish tissue have declined dramatically, DDT compounds may still pose adverse health risks to fish species when bioaccumulated from contaminated environments.

In addition to the compounds discussed above, several other constituents are present and affect the water quality of the Rio Grande. These include nutrients such as nitrates, nitrites, and phosphorus, total dissolved solids (salinity), and radionuclides. Each of these also has the potential to affect the aquatic ecosystem and health of the silvery minnow. As the river dries, pollutants will be concentrated in the isolated pools. Although the water may not cause the immediate death of silvery minnows, the evidence suggests that because of the amount and variety of pollutants present in the Rio Grande, their health and fitness could be compromised.

Silvery Minnow Propagation

Fish species have been propagated and cultured for more than one hundred years in the United States and other countries. The United States began species propagation in 1871, when a bill was passed in Congress that acknowledged the Federal government's role in natural resource management. The resolution stated "The most valuable food fishes of the coast and the lakes are rapidly diminishing in number, to the public injury and so as materially to affect the interests of trade and commerce. " One year later, the first national fish hatchery was established in California. At that time, and for more than 100 years since, fish hatcheries existed to rear game fishes, restore stocks, and introduce sport fishes to new areas (Springer 2002).

The ESA obliged Federal agencies to become guardians of endangered fish species. The current role of the Service in this stewardship is that of lead authority and protector of threatened and endangered fish in the United States. This includes protection of the habitats upon which these species depend, as well as recovery of populations that have been diminished due to habitat degradation, excessive harvesting, water quality issues, or other factors (Edwards 1993). With the passage of the ESA, the National Fish Hatchery System not only had to change its methods of operation, but its philosophy as well. The first step in this new direction was taken at Dexter National Fish Hatchery (Hatchery). The Hatchery, a 40-year-old warm water facility originally designed to breed largemouth bass (*Micropterus salmonoides*) and channel catfish (*Ictalurus punctatus*) for New Mexico, was transformed into an endangered fish-rearing facility and technology center.

The Hatchery has been a leader in the development of captive propagation techniques and has reared some of the rarest fish in the country. These include the Colorado pike minnow *(Ptychocheilus lucius*) as well as the Gila topminnow (*Poeciliopsis occidentalis*). There are at least fifteen species of threatened or endangered fish being cultured at the Hatchery. These species include the silvery minnow and many other cyprinids such as the bandtail chub (*Gila elegans*), Pahranagat roundtail chub (*Gila robusta jordani*), chihuahua chub (*Gila nigrescens*), Virgin River chub (*Gila robusta seminuda*), woundfin (*Plagopterus argentissimus*), and the Guzman beautiful shiner (*Cyprinella formosa formosa*).

Propagation of minnows in the United States began in the early 1930s with the culture of bait fish to support sport fisheries. Golden shiners (*Notemigonus crysoleucas*), bluntnose minnows

(*Pimephales notatus*), fathead minnow (*Pimephales promelas*), and eastern silvery minnow (*Hybognathus regius*) were propagated to provide bait for game fish (Markus 1934, Raney 1941). Many aspects of culturing bait fish in ponds were described as early as 1938. Unfortunately silvery minnow has proved more difficult to raise in captivity. The greatest success has occurred at the Hatchery but other facilities have experienced high levels of mortality (J. Brooks, *in litt.* 2001).

Propagation of silvery minnow began in 2000 to determine the feasibility of raising large numbers of silvery minnows to augment wild populations. Adult wild silvery minnows from the San Acacia Reach and eggs from San Marcial were collected for a pilot propagation and augmentation program. Wild gravid adults were successfully spawned in captivity at the Albuquerque Biological Park (ABP). Approximately 500 silvery minnows were induced to spawn producing approximately 203,600 eggs. These eggs were raised for 2 to 3 days and released as larval fish at Bernalillo (91,600) and Los Lunas (112,000)(Platania and Dudley 2001). The estimated survivorship for these larval fish to adulthood is estimated to be one to five percent, which would equate to net augmentation ranging between 916 to 4,580 and 1,120 to 5,600 adult fish in the Angostura and Isleta Reaches, respectively.

In 2000, an estimated 41,498 silvery minnow eggs were collected in three days just below the San Marcial railroad trestle (Smith 2000). The eggs were transported to the ABP propagation facility where they were raised to adults. The eggs had an estimated five to 10 percent survivorship resulting in approximately 2,075 to 4,150 adult silvery minnows (C. Altenbach, ABP, pers. comm. 2002). However, since this project was only anticipated to rear 1,000 adult silvery minnows from 10,000 eggs, approximately 2,500 juvenile silvery minnows were released in the Angostura Reach of the Rio Grande in July of 2000.

Silvery minnow eggs were salvaged from the Rio Grande in 2001 to supplement the captive population. During spring runoff in mid-May, approximately 150,000 wild eggs were collected near the headwaters of Elephant Butte Reservoir. From May 17 to 19, 2002, the catch of silvery minnow eggs collected for captive propagation is conservatively estimated to be 922,000 (Platania and Dudley 2003). These eggs were transported to captive propagation units where they were raised to sub-adults and adults for release back into the wild. Silvery minnow adults were spawned artificially using hormones throughout 2001 and into early 2002. In April of 2002, the ABP spawned silvery minnows in captivity for the first time without the use of hormones (C. Altenbach, ABP, pers. comm. 2002).

Silvery minnows are currently being propagated at five facilities in New Mexico. The New Mexico facilities are: Dexter National Fish Hatchery and Technology Center; New Mexico State University Coop Unit; Rock Lake State Fish Hatchery; U. S. Fish and Wildlife Service Fishery Resources Office, and the ABP. These facilities are actively propagating and rearing silvery minnows or are available for propagation. The total combined capacity of these facilities is estimated at 500,000 silvery minnows. Silvery minnows are also held in South Dakota at the U.S. Geological Survey, Biological Resources Division (USGS-BRD) Lab, but there is no active spawning program at this facility.

Ongoing Research

There is on-going research by the NMFRO and University of New Mexico (UNM) to examine the movement of silvery minnows. The fish are marked with a visible flourescent elastomer tag and released in large numbers in a few locations. Crews then sample intensively upstream and downstream from the release site in an attempt to capture the marked fish. In January 2002, approximately 13,000 silvery minnows were released by UNM into the San Acacia Reach; in June 2002, 2,082 silvery minnow were released 500 m above the Alameda Bridge in Albuquerque; in December 2002, 41,500 silvery minnow were released in Rio Rancho; and in January 2003, approximately 61,000 silvery minnows were released in Bernalillo. The last three releases were made by NMFRO. In addition to providing information on movement, these releases will augment the wild population.

Preliminary results indicate that the majority of silvery minnows remain near the release site or move downstream. However, one individual swam 17.7 miles upstream from its release site (S. Platania, UNM, pers. comm. 2003). Monitoring within 48 hours after the release of the 41,500 silvery minnows resulted in the capture of 937 fish. Of these, 928 were marked and 927 were collected downstream of the release point. These results also indicate that planted silvery minnow were much more abundant than wild individuals in this reach of the river. In general, fish planted in rivers tend to remain near their release point or drift downstream a short distance. It is unknown if the preliminary results for the silvery minnow reflect this same phenomenon, if they indicate that the fish are sedentary, or if they indicate that just the adults are sedentary. Perhaps if juveniles were marked a different result would be observed. However, the results are too preliminary to draw any conclusions at this time.

In 2002, a hybridization study between the plains minnow and silvery minnow was conducted to determine the genetic viability of hybrids. The results are preliminary because the number of trials was low and because there is some question about the fitness of the females used in the experiments. The plains minnow and silvery minnow did spawn with each other and the hybrid eggs hatched. However, none of the larvae lived longer than 96 hours. The control larvae (non-hybrids) for both the plains minnow and silvery minnow lived until the end of the study (24 days) (Caldwell 2002). The results of this research are important because if the silvery minnow is to be re-introduced into the Pecos River, it is important to know if hybridization (or competition) with the plains minnow will preclude successful establishment of the silvery minnow.

Due to the increased efforts in captive propagation, recent studies have been developed by UNM on the genetic composition of the silvery minnow. Recent research indicates that the net effective population size (N_e) of the silvery minnow in the wild is between 60-250 fish (T. Turner, UNM, pers.comm. 2003). It has been suggested that a N_e of 500 fish is needed to retain the long-term adaptive potential of a population (Franklin 1980). No significant genetic differences have been found in populations isolated in the different reaches of the Rio Grande (D. Alo UNM, pers.comm. 2002). Because the number of wild fish in the river appears to be very low, the addition of thousands of silvery minnows raised in captivity could have a major impact on the genetic structure of the population. It is estimated that a minimum of 100,000 silvery minnows are needed to maintain a genetically healthy broodstock and that 1,000,000 would be optimal (T. Turner, UNM, pers. comm. 2001). Captive propagation efforts will need to be carefully managed to ensure the long-term viability of the species.

Permitted and/or Authorized Take

Table 4 (Appendix E, Table 4) outlines silvery minnow take authorized via section 10 and incidental take permitted under section 7. These permits and/or authorizations are issued by the Service. Applicants for section 10 permits must also acquire a permit from the State to "take" or collect silvery minnows. Many of the permits issued under section 10 allow take for the purpose of collection and salvage of silvery minnows and eggs for captive propagation. Eggs, larvae, and adults are also collected for scientific studies to further our knowledge about the species and how best to conserve it. Since 2000, the Service has reduced the amount of take permitted for voucher specimens as a result of the increasingly precarious status of the species in the wild. The only incidental take authorized for silvery minnows under section 7 was associated with the June 29, 2001, biological opinion.

Other Projects

On the Middle Rio Grande, the following past and present Federal, State, private, and other human activities, in addition to those discussed above, have affected the silvery minnow and its critical habitat:

1. Release of Carryover Storage from Abiquiu Reservoir to Elephant Butte Reservoir: The Corps consulted with the Service on the release of water during the winter of 1995. Ninety-eight thousand ac-ft (12,054 hectare-meters) of water was released from November 1, 1995, to March 31, 1996, at a rate of 325 cfs (9.8 cm). This discharge is above the historic winter flow rate. Substantial changes in the flow regime that do not mimic the historic hydrograph can be detrimental to the silvery minnow. For example, during the winter release habitat study, Dudley and Platania (1996) observed an apparent increase in flow between two winter sampling trips, January 19 – 26, 1996, and February

3 – 5, 1996, resulting in a decrease in low-velocity and side-channel habitats favored by silvery minnows.

2. Corrales, Albuquerque, and Belen Levees: These levees contribute to floodplain constriction and habitat degradation for the silvery minnow. Levees at these sites contribute to the degradation of the environmental baseline by reducing the amount and quality of suitable habitat for the silvery minnow.

3. Low Flow Conveyance Channel Experimental Operations: In December 1994, Reclamation submitted a BA addressing the diversion of water from the Rio Grande into the LFCC to study the effects of channel gradient and sedimentation on water delivery. The Federal action evaluated the alternative of installing a temporary outfall to the river and diverting water during spring runoff for three consecutive years. Experimental diversions into the LFCC began in May 1997 and continued through June 1997. Experimental diversions began again in early March 1998, and continued until the end of spring runoff. This resulted in the entrainment of silvery minnow eggs and subsequent recruitment of silvery minnow adults into the LFCC. Experimental operations began again on May 20, 2001. Since then, no entrainment of silvery minnows has been documented. This lack of entrainment has led to speculation that there was little or no spawning occurring in the upstream reaches.

   In March, 2002, the Service received a BA from Reclamation for additional LFCC experimental operations and for parrot feather removal. The Service has completed a draft biological opinion for this project.

4. Tiffany Plug Removal: This Reclamation project cut a pilot channel in the Rio Grande upstream of the bridge at San Marcial. The purpose of this project was to direct water flow through the excavation, rather than allow the water to flow into the adjacent floodplain, resulting in a straighter, narrower, and deeper channel. This caused the narrowing of the river channel which reduced the hydrologic diversity needed by the silvery minnow.

5. Temporary Channel to Elephant Butte: This Reclamation project involved the construction of a temporary channel through the delta area of Elephant Butte Reservoir to increase the efficiency of sediment and water conveyance. An additional project goal was to initiate some degradation of the river bed through the San Marcial Reach to increase overall channel capacity and potentially allow for higher peak releases from Cochiti Dam during subsequent spring runoff periods.

Measures were implemented to minimize impacts on the silvery minnow and flycatcher and their associated habitats and to enhance local riparian conditions. These environmental actions included: Adding sinuosity to the temporary channel; constructing the channel with variable width; constructing low water crossings along the temporary channel to allow overbank flows to inundate existing native riparian vegetation and encourage native revegetation; a channel widening project in the southern reach of the Refuge to improve aquatic and riparian habitat; and creation of an inflow channel to a portion of the eastern floodplain north of Black Mesa to encourage sediment deposition and new habitat creation.

6. <u>Santa Ana River Restoration Project</u>: In August 1999, Reclamation submitted a biological assessment to the Service to proceed with a restoration project located on Santa Ana Pueblo in an area where the river channel was incising and eroding into the levee system. This project is currently under construction and involves components such as, a Gradient Restoration Facility (GRF), channel re-alignment, bioengineering, riverside terrace lowering, and erodible banklines. The primary component of the Santa Ana Restoration Project is a GRF which will provide control of the river hydraulics upstream of its location and also river bed control. The GRF was designed to: (1) Store more sand sediments at a stable slope for the current sediment supply; (2) decrease the velocities and depths and increase the width in the river channel upstream; (3) be hydraulically submerged at higher flows while simultaneously increasing the frequency and duration of overbank flows upstream; (4) provide velocities and depths suitable for passage of the silvery minnow through the structure; and (5) halt or limit further channel degradation upstream of its location. The channel re-alignment involves moving the river away from the levee system and over the grade control structure. This activity involves excavation of a new river channel and floodplain. Another significant component of the Santa Ana Restoration project is riverside terrace lowering for the creation of a wider floodplain. The bioengineering and deformable banklines are also involved to assist in establishing the new channel bank and re-generating native species vegetation in the floodplain.

7. <u>Cochiti Fish Screens:</u> This Corps project involved the reparation of fish screens located on the headworks of the Sile and Cochiti Eastside Main Canals in the stilling basin of Cochiti Dam in November 1999. The repair work took approximately six hours per work day for four days and involved reducing outflow from Cochiti Dam to approximately 100 cfs during the six hours of work each day. Conditions that had to be met for the work to progress included: (1) A minimum 700 cfs release prior to and following the release reduction to 100 cfs for repairs; (2) the release reduction could not occur before 9:00 AM and could last for a maximum duration of six hours; (3) drawdown to 100 cfs for six hours could be undertaken only for two consecutive days, and additional repair and release reduction would be deferred to no more than two consecutive days the following week if needed; and (4) all repairs had to be completed prior to December 1, 1999, to minimize disturbance of bald eagles.

8. Silvery Minnow Augmentation: The Service completed an intra-Service section 7 consultation on the salvage and controlled propagation of silvery minnow in 2000. This consultation covered the collection of free floating silvery minnow eggs below the San Marcial Railroad Bridge and the collection of wild adult silvery minnows for spawning. This consultation set forth measures to limit silvery minnow mortality during collection and rearing.

9. Salvage of Silvery Minnows: The Service completed an intra-Service section 7 consultation of the salvage of silvery minnows from isolated pools in 2000. This consultation set forth measures to limit silvery minnow mortality during collection.

10. Creation of a Conservation Pool for Storage of Native Water in Abiquiu and Jemez Canyon Reservoirs and Release of a Spike Flow: This Corps project created space (100,000 ac-ft) in Abiquiu and Jemez Canyon Reservoirs to store Rio Grande Compact credit water for use in 2001, 2002, and 2003 for the benefit of listed species. The conservation pool was created with the understanding that the management of this water would be decided in later settlement meetings or during water operations conference calls. In addition, a supplemental release (spike) occurred in May 2001 to accommodate movement of sediment as a part of habitat restoration and construction on the Rio Grande and Jemez River on the Santa Ana Pueblo.

11. Bosque del Apache National Wildlife Refuge Water Management Plan: Bosque del Apache National Wildlife Refuge completed an intra-Service section 7 consultation in May 2001, for the use of 869 ac-ft of their consumptive appropriation water right of 7,409 ac-ft from the Rio Grande for the years 2001 through 2004 to aid in maintenance of habitat for the silvery minnow if: (1) Refuge is presented with data indicating that the addition of limited Refuge water will foster survival of the species; (2) an equal or greater percentage of water by other water users in the Middle Rio Grande Valley is also contributed; and (3) legal permitting from the Office of the State Engineer is obtained prior to the emergency transfer request.

12. Programmatic Biological Opinion on the Effects of Actions Associated with the U. S. Bureau of Reclamation's, U.S. Army Corps of Engineers', and non-Federal Entities' Discretionary Actions Related to Water Management on the Middle Rio Grande: The Service completed this biological opinion on June 29, 2001, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion had one Reasonable and Prudent Alternative (RPA) with several elements. These elements set forth a flow regime in the Middle Rio Grande and

described many habitat improvements necessary to alleviate jeopardy to both the silvery minnow and flycatcher.

Summary

In summary, the remaining population of the silvery minnow is restricted to five percent of its historic range. Every year since 1996, there has been at least one drying event in the river that has further reduced the silvery minnow population. Mortality estimates for the April 1996, dewatering event have been as high as two-thirds of the silvery minnows present in the San Acacia Reach, which would represent 47 percent of the total range-wide population. The consequences of the 1996 mortality event are currently unknown, but the species' near-term status, and likely long-term recovery potential were adversely affected. Dead silvery minnows have been documented in a dry riverbed in 1999, 2000, 2001, and 2002 (Platania and Dudley 1999; J. Smith, NMESFO, pers. comm. 2002; U.S. Fish and Wildlife Service 2002).

Data collected during the summers of 2000, 2001, and 2002 indicate a near-absence of Age 0 silvery minnows in the Middle Rio Grande, suggesting that the population has dramatically decreased since 1999 (Smith and Jackson 2000, Hoagstrom and Brooks 2000, Dudley and Platania 2002). There was a slight increase in silvery minnow abundance in the Angostura and Isleta Reaches in 2001; however these slight gains were lost in 2002 (Dudley and Platania 2002). The population is unable to expand its distribution, because three diversion dams currently block upstream movement and Elephant Butte Reservoir blocks downstream movement. Augmentation of silvery minnow with captive-reared fish will continue, however continued monitoring and evaluation of these fish will be necessary for obtaining information regarding the survival and movement of individuals.

Water withdrawals from the river and water releases from dams severely limit the survival of silvery minnows. The consumption of groundwater and surface water for municipal, industrial, and irrigation uses continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow (Reclamation 2002). However, under state law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system. The City of Albuquerque, for example, has been offsetting their surface water depletions with 60,000 ac-ft per year (City of Albuquerque, *in litt*., 2002). The combined effect of water withdrawals and the drought mean that discharge from WWTPs and irrigation return flows will have greater importance to silvery minnow and a greater impact of water quality. Lethal levels of chlorine and ammonia have been released from the WWTPs in the last several years. In addition, a variety of organic chemicals, heavy metals, nutrients, and pesticides have been documented in the river and contribute to the overall degradation of water quality.

Southwestern Willow Flycatcher

Status of the Species within the Action Area

Presence/absence and nest monitoring surveys along the Rio Grande have been conducted since 1993. Table 5 (Appendix E, Table 5) presents the results of surveys for flycatchers at these sites from 1994 through 2002.

Chama River

Surveys for presence/absence and habitat suitability along the Rio Chama below Abiquiu Dam in 1994 identified no flycatchers, but found small areas of suitable habitat (Eagle Ecological Services 1994). A Service biologist recorded an unidentified willow flycatcher about a quarter-mile from the Rio Chama near Chili, New Mexico (Eagle Ecological Services 1994). More recent data also indicate that the Rio Chama may be used by flycatchers. Several flycatcher territories were identified each breeding season from 1993 –1998 in the Rio Chama drainage until surveys were discontinued, including areas near Parkview, above Heron Reservoir (New Mexico Department of Game and Fish 1995), and in the vicinity of Los Ojos. Non-protocol surveys have indicated that at least a few birds have persisted.

Velarde Area

In 1995, several individual flycatchers were observed along the river near Velarde, New Mexico. In 1996, flycatchers were again detected during the breeding season in the Española valley (Ahlers and White 1996). Nesting attempts were documented at three sites in the Española valley (Johnson *et al.* 1999). The three sites in the Velarde section of the Rio Grande had one territory in 2001.

San Juan Pueblo

In 1995 nesting flycatchers were located on the San Juan Pueblo. In 2000, protocol surveys found 16 territories on San Juan Pueblo lands. This site has not been surveyed since 2000.

Isleta Pueblo

In 2000, 14 territories were located on Isleta Pueblo lands. These sites have not been consistently surveyed. Habitat quantity and quality has not changed since 2000.

La Joya State Wildlife Refuge

In 2001, seven territories and five nests were located. Three of the nests were successful. Two nests were parasitized with a cowbird egg, however, one successfully fledged two flycatcher young. In 2002, six territories and five nests were located. Three nests were successful and two nests were parasitized by cowbirds. One parasitized nest fledged a flycatcher young.

Sevilleta National Wildlife Refuge

In 1999, four flycatcher territories within the Sevilleta National Wildlife Refuge were discovered by Reclamation while conducting routine neotropical migrant point counts in late May. Follow-up point counts confirmed the detected individuals to be residents and formal surveys in the area of detection began on June 21, 1999. Nesting was confirmed at three of the territories. Two nests were successful, and the third failed for unknown reasons. Results of surveys for 2000 revealed two nests at this location. These were the first documented occurrences of territory establishment and successful breeding in areas adjacent to the river dominated by salt cedar and Russian olive within Reclamation's study area (Ahlers and White 2000). In 2001, four territories and four nests were located. Three of the nests were successful and one failed (Ahlers *et al.* 2002). Although, three nests were parasitized by cowbirds. Two of the parasitized nests fledged two flycatcher young. In 2002, six territories and eight nests were located. Five nests were successful and one nest was parasitized. (Ahlers *et al.* unpublished data).

Bosque Del Apache National Wildlife Refuge

In 2001, one territory was located during surveys of suitable habitat within actively managed wetland and riparian units of the refuge and/or along water conveyance facilities. In the past, one territory was located in 2000, and two to three territories in 1999. There are two sites on the refuge that have been used fairly consistently since 1994. Nest searches are not conducted on the refuge, therefore nest status and productivity cannot be confirmed. In 2002, the river corridor was surveyed in addition to selected areas within the inactive floodplain of the refuge. Three territories were located along the river however no pairs or nests were found. One territory was located within the Refuge's seasonally flooded marsh units (Taylor 2001, 2002).

San Marcial

In 1994, 11 flycatcher territories were detected in the San Marcial area, all above the San Marcial Railroad Bridge (Mehlhop and Tonne 1994). In 1995, flycatchers were observed on the west bank of the Rio Grande south of Isleta Marsh within the Belen Division, and in the lower portion of the Socorro Division, both above and below the San Marcial Railroad Bridge (Ahlers and White 1995). Also in 1995, several individuals were observed along the river near Velarde, New Mexico, and nesting flycatchers were located on the San Juan Pueblo. In 1996, flycatchers were again detected during the breeding season below the San Marcial Railroad Bridge and in the Española valley (Ahlers and White 1996). Nesting attempts were documented at three sites in the Española valley and at one site in the San Marcial area (Johnson *et al.* 1999).

In 1997, flycatchers were observed during Reclamation surveys at three sites between the San Marcial Railroad Bridge and Elephant Butte Reservoir (Ahlers and White 1997). Sites containing flycatchers in the San Marcial Reach were dominated by dense stands of willow with cottonwood interspersed, and were in or near flooded areas at some point during the breeding season. Two nests were found in the headwater area of Elephant Butte Reservoir west of the LFCC in a patch of Goodding willows. Both of these nests may have been successful. The nests were located within the same territory about 5 meters apart. Because the second nest was being incubated following the estimated fledging date of the first nest, this could have been a renesting by the same pair (Ahlers and White 1997).

In 1998, a total of twenty flycatchers were observed from the San Marcial Railroad Bridge to Elephant Butte Reservoir including four confirmed pairs and two nests. A new nest was located on the east side of the river just below the San Marcial Railroad Bridge. The other nest was located near the 1997 nest site, west of the LFCC breach.

In 1999, 28 flycatchers established 10 pairs with 9 nests. At the San Marcial Reach, 12 territories were confirmed by 5 nests. Four of the nests were successful and one failed due to cowbird parasitism. It is estimated that ten young fledged the nesting sites (Ahlers and White 2000).

Presence/absence surveys in the San Marcial Reach in 2000 produced the following data: LF-27 (east of the Rio Grande below the San Marcial Railroad Bridge) had two pairs with nests, LF-11 (between the LFCC and the Rio Grande, below the Ft. Craig berm) had one pair with nest, and LF-17 (west of the LFCC outfall and Rio Grande above the Reservoir delta) had 14 pairs with nests. Successful nests in this area could have been as high as 12 (D. Ahlers, Reclamation, pers. comm. 2000)

In 2001, this area had the highest concentrations of nesting flycatchers within the reach with 22 territories. These 22 pairs produced 35 nests including 4 re-nesting attempts and 10 second broods. Twenty-six nest attempts were successful and nine failed (seven were predated and two were abandoned).

In 2002, 51 territories were established within the delta. Sixty-five nests that were located included six second broods and fourteen re-nests. Thirty-five nests were successful and 30 failed. The higher than normal nest failure in 2002 was attributed to predation (D. Alhers, Reclamation, pers. comm. 2002).

Habitat Characteristics

Riparian habitat within all these reaches includes dense stands of willows and cottonwoods adjacent to or near the river channel. Other reaches in the Middle Rio Grande support local areas of suitable flycatcher habitat (e.g., the Middle Reach). However, no birds have been observed establishing territories. The Belen, Rio Puerco, Socorro and San Marcial reaches also contain dense stands of salt cedar. Flycatchers (and many other species of neotropical migrant landbirds) use the Rio Grande riparian corridor as stop-over habitat during migration. Studies have shown that during the spring and fall migration, flycatchers are more commonly found in willow habitats than in other riparian vegetation types, including the narrow band of coyote willows that line the LFCC within the Refuge (Finch and Yong 1997). Recent presence/absence surveys during May have detected migrating flycatchers throughout the project area in vegetation types that are classified as "low suitability" for breeding habitat (Ahlers and White 1997).

Habitat Availability by Reach

Table 7 (Appendix E, Table 7) outlines flycatcher habitat availability by river reach.

The Velarde Reach has a narrow riparian zone with active woody species regeneration and limited non-native vegetation. Habitat quality and vegetation varies considerably within this reach. Some bosque areas contain older, more mature cottonwood trees that are 30-50 ft tall. Russian olive and Siberian elm trees occur on some banklines and river bars. Other areas support stands of dense willows with canopy trees. Overbank flooding is localized but regular. The high potential for bank erosion may increase the dynamics of riparian vegetation loss and regeneration. All habitat patches within this reach where flycatchers have been detected in the past were dominated by willow and were inundated by overbank flooding or irrigation return flows. Nearby habitat included mature cottonwoods, open areas and Russian olives.

The Española Reach contains older aged riparian habitat with numerous oxbows and some encroachment of non-natives. A significant geomorphic feature of this reach is the destabilization of the channel and lowering of the river bed and water table caused by within-channel gravel mining. About 20 acres of native vegetation have been lost due to this activity.

The bosque in the Cochiti and Angostura Reaches contains mainly single-aged stands of older cottonwoods and lacks the diversity of a healthy, multi-aged riparian forest. Non-native vegetation such as Russian olives and Siberian elms are also becoming established. Significant channel narrowing and downcutting has limited overbank flooding and reduced the potential for recruitment of native riparian vegetation, especially cottonwoods and willows. Known flycatcher habitat in some areas of the Isleta Reach consists of dense willow and cottonwood stands associated with floodplain marshes (i.e. below Isleta Diversion Dam). Flycatcher habitat adjacent to the river within the Sevilleta National Wildlife Refuge contains salt cedar and Russian olive. Channel narrowing and degradation in this reach reduces the amount of overbank flooding and the potential sites for existing and new native vegetation. Known flycatcher habitat in the Rio Puerco Reach is dominated by salt cedar.

Development of a flycatcher habitat suitability model by Reclamation's Denver Technical Service Center was initiated in 1998, and further refined in 1999. Vegetation within the reach was mapped using the Hink and Ohmart classification system through a cooperative effort with the U.S. Forest Service. Breeding habitat suitability was refined by identifying all areas that are within 100 meters of existing watercourses, ponded water, or in the zone of peak inundation. The 5 categories of flycatcher habitat that lie within 100 meters of water were defined as:

- <u>Highly Suitable Native Riparian</u> - Stands dominated by willow and/or cottonwood.
- <u>Suitable Mixed Native/Non-native Riparian</u> - Includes stands of natives mixed with non-natives.
- <u>Marginally Suitable Non-native Riparian</u> - Stands composed of monotypic salt cedar or stands of salt cedar mixed with Russian olive.
- <u>Potential with Future Riparian Vegetation Growth and Development</u> - Includes stands of very young sparse riparian plants on river bars that could develop into stands of adequate structure with growth and/or additional recruitment. Reclamation believes this category requires regular monitoring to ascertain which areas contain all the parameters to become flycatcher habitat.
- <u>Low Suitability</u> - Includes areas where native and/or non-native vegetation lacks the structure and density to support breeding flycatchers, or exceeds the hydrologic parameter of greater than 100 meters from water. The presence of low suitability habitats may be important for migration and dispersal in areas where riparian habitats have been lost (i.e. agricultural and urban areas).

Currently, the Service groups the first three categories listed above as equally suitable habitat for the flycatcher, because a large number of sites are currently occupied in all three categories. At this time, it is not accurate to define those suitable habitats with non-native vegetation as being less suitable than native habitat for flycatchers.

The Rio Grande in the San Acacia Reach supports a high value riparian ecosystem. The native riparian trees and shrubs are interspersed with stands of nonnative riparian plants, primarily salt cedar and Russian olive. There is native desert habitat on both sides of the floodplain. This area is unique on the Rio Grande because of the lack of agricultural and urban development on the outside edges of the floodplain. This area represents a relatively unfragmented landscape with associated high biological values. For this reason, the San Acacia Reach is considered a priority area for riparian restoration and/or maintenance.

Factors Affecting Species Environment within the Action Area

In the Middle Rio Grande, past and present Federal, State, private, and other human activities that may affect the flycatcher include irrigated agriculture, river maintenance, flood control, dam operation, water diversions, and downstream Rio Grande Compact deliveries. The Rio Grande and associated riparian areas are a dynamic system in constant change. Without this change, the riparian community will decrease in diversity and productivity. Sediment deposition, scouring flows, inundation, base flows, and channel and river realignment are processes that help to maintain and restore the riparian community diversity. Habitat elements for the flycatcher are provided by thickets of riparian shrubs and small trees and adjacent surface water, or areas where such suitable vegetation may become established.

The Rio Grande historically had highly variable annual and seasonal discharge patterns (Platania 1993). Since 1973, flows in the Middle Rio Grande have been determined mainly by regulation of dam facilities and irrigation diversions. The highest flows generally result from snow-melt (April-May), irrigation water releases from the upstream reservoirs, and variable thunderstorms. Lowest flows generally occur from July to October, when most of the available river flow is diverted for irrigation. Summer monsoons can elevate river flows during this time period depending on their frequency and intensity. Water and sediment management have resulted in a large reduction of suitable habitat for the flycatcher, as a result of the reduction of peak flows that helped to create and maintain habitat for this species.

Anthropogenic encroachment into the historic floodplain, through conversion of native habitats to cropland, and construction of bridges and houses has reduced peak-flow releases from Cochiti Dam to prevent property damage. Overbank flooding is needed to create shallow, low velocity backwaters, and to maintain and restore native riparian vegetation for flycatcher habitat. Overbank flooding is also currently restricted by the safe channel capacity at the San Marcial Railroad Bridge. There are three houses in the floodplain at Socorro, and a new residential development in the floodplain 0.25 mile (0.15 km) downstream of Bernalillo. These urban developments are not protected by levees.

Levees have greatly restricted the floodplain width and functionally disconnected the river from most of the floodplain. A comparison of river habitat changes between 1935 and 1989 shows a 49 percent reduction of river channel habitat from 22,023 acres (8,916 ha) to 10,736 acres (4,347 ha) (Crawford *et al.* 1993). Between Cochiti Dam and Elephant Butte Reservoir headwaters, there are 235 miles (378 km) of levees (includes distances on both sides of the river).

The Middle Rio Grande channel width has narrowed over the last century. The trend can be attributed to reduced peak flows, channelization, and reduced sediment below Cochiti Dam. Channelization is primarily responsible for the elimination of thousands of acres of the shallow, low velocity habitats required by the flycatcher. Flow regulation below Abiquiu Reservoir and Cochiti Dam has further decreased channel capacity and reduced peak flows. A channel-forming discharge has never been released from Cochiti Dam. The lack of large peak flows combined with the adverse effects of channelization contributes significantly to channel narrowing and the elimination of overbank flooding. These factors severely limit the development of backwater habitats essential to the survival of the flycatcher.

Water Operations

The operation of El Vado and Abiquiu Dams on the Rio Chama, Cochiti Dam on the Rio Grande, and the three mainstem diversion dams below Cochiti (Angostura, Isleta, and San Acacia) have modified river flows and downstream channel morphology. Downstream effects of Cochiti Dam include the narrowing of the river channel and associated loss of flycatcher habitats, the degradation of the river bed and concurrent reduction in overbank flooding. In addition, the diversion dams have the capability to dry up the river channel completely by diverting all the flow into the irrigation system. The following discussion summarizes the dewatering events in the Middle Rio Grande from 1996 to 2002.

In 1996, at least 36 river miles in the Middle Rio Grande were dry for 128 days. This event may have contributed to complete failure of adjacent flycatcher nests (Johnson *et al.*, 1999). In 1997, at least 16 river miles were dry for approximately 5 to 7 days and in 1998, approximately 16 river miles were dry for 28 days. In 1999, the river was dewatered for 4 to 5 days for at least 28 river miles. Drying occurred in 2000 for less than a week in late July,. in 2001, very little river dried, and in 2002 approximately 40 miles of river dried. The years since 1996 have shown reduced amounts and durations of river dewatering.

In 1996, the known flycatcher population numbered four nesting pairs and all nests failed. In 1997, there were three known pairs of flycatchers. In 1998, there were four known pairs with two nests. In 1999, there were 28 known flycatchers, including 12 territories, 10 pairs and 9 nests. In 2000, there were approximately 72 known flycatcher territories, with at least 17 nests.

In 2001, there were approximately 70 known flycatcher territories, with 45 nests attempted, and 33 believed successful. In 2002, there were approximately 96 known territories and at least 74 nesting attempts, with 80 nests attempted, and 44 believed successful.

The large increases seen in the flycatcher numbers along the Middle Rio Grande are in part due to increased survey coverage. However, in the past few years the survey effort has become more standardized and increases in the number of territories has been documented in the Sevilleta/La Joya area and in the San Marcial area. This increase can be attributed to a number of conditions. In the Sevilleta/La Joya area, the nesting sites are wetted by the Rio Puerco confluence with the Rio Grande and the presence of the San Juan Irrigation Drain, which provides water though the irrigation season. In the San Marcial area, the majority of the nesting sites are wetted by a break in the LFCC, which provides water throughout the irrigation season. In addition to irrigation returns, the increased quantity of continuous river flow since 1996 has provided water adjacent to nesting areas along the Rio Grande which has increased production of their insect prey and dense riparian vegetation.

Past Consultations

Since listing in 1995, at least 81 Federal agency actions have undergone (or are currently under) formal section 7 consultation throughout the flycatcher's range (Appendix E, Table 8). Six actions have resulted in jeopardy decisions. Many activities continue to adversely affect the distribution and extent of all stages of flycatcher habitat throughout its range (development, urbanization, grazing, recreation, native and non-native habitat removal, dam operations, river crossings, ground and surface water extraction, etc.). Stochastic events also continue to adversely affect the distribution and extent of flycatcher habitat.

Anticipated or actual loss of occupied flycatcher habitat due to Federal or federally permitted projects has resulted in biological opinions that led to acquisition of otherwise unprotected property specifically for the flycatcher. A small portion of the lower San Pedro River was acquired by Reclamation as a result of raising Roosevelt Dam and is now currently under the management of The Nature Conservancy. In 2002, about 20 flycatchers territories were detected on this property (S. Sferra, Reclamation, pers. comm.). Commitments to acquire and manage unprotected habitat specifically for breeding flycatchers have been made for loss of flycatcher habitat along the Lower Colorado River (Operations of Colorado River dams and 4.4 Plan/Change in Points of Diversion), Big Sandy River (Hwy 93 Bridge), Verde River (Mingus Ave. Bridge), Tonto Creek and Salt River (raising of Roosevelt Dam) in AZ and Lake Isabella, CA (operation of dams).

Much of the increase in the flycatcher's numbers in central Arizona and the subspecies range can be attributed to the rapid growth at Roosevelt Lake; however, much of that occupied habitat is expected to be lost in the future due to inundation. Reclamation consulted on the new area of inundation around the perimeter of Roosevelt Lake as a result of raising the dam (Service1996b). The Service's biological opinion provided to Reclamation authorized the incidental take of 45 pairs (or 90 flycatchers) around the perimeter of Roosevelt Lake. However, an additional 96 territories were found at Roosevelt Lake by 2001. This totals 141 territories, representing 14 percent of all territories in the subspecies range and 40 percent of all known territories in Arizona. Nearly all are located in the center of the conservation pool surrounded by the area consulted on by Reclamation, but not addressed by that consultation. Thus, the first large storm runoff that enters Roosevelt Lake is expected to inundate large areas of habitat used by breeding flycatchers. The Salt River Project, operators of Roosevelt Dam, received an incidental take permit for all flycatchers and their habitat at Roosevelt Lake by developing a Habitat Conservation Plan (67 CFR 71193).

The complete inundation of the occupied breeding habitat at Roosevelt Lake and future uncertainty of re-colonization rate or frequency, could limit the remaining abundance and distribution of flycatcher territories in central Arizona (Gila, Maricopa, and Yavapai counties) to 5 along the Verde River (from 2000 surveys) and 1 along the Hassayampa River. This emphasizes the critical need in Arizona for the protection and expansion of territories at existing sites and the development of suitable habitat for birds to colonize. In central Arizona, streams with the best physical characteristics to develop abundant flycatcher habitat are the Verde River and Tonto Creek (T. McCarthey, AGFD, pers. comm.).

On the Middle Rio Grande, the following past and present Federal, State, private, and other human activities, in addition to those discussed above, have affected the flycatcher:

1. Corrales, Albuquerque, and Belen levees: These levees contribute to floodplain constriction and habitat degradation for the flycatcher. Levees at these sites contribute to the degradation of the environmental baseline by reducing the amount of suitable or potentially suitable habitat for the flycatcher.

2. Tiffany Plug Removal: This Reclamation project cut a pilot channel in the Rio Grande upstream of the bridge at San Marcial. The purpose of this project was to direct water flow through the excavation, rather than allow the water to flow into the adjacent floodplain, resulting in a straighter, narrower, deeper channel. This caused the narrowing of the river channel which reduced overbank flooded habitat needed by the flycatcher.

3. Santa Ana River Restoration Project: In August 1999, Reclamation submitted a biological assessment to the Service to proceed with a restoration project located on Santa Ana Pueblo in an area where the river channel was incising and eroding into the levee system. This project is currently under construction and involves components such as, a Gradient Restoration Facility (GRF), channel re-alignment, bioengineering, riverside terrace lowering, and erodible banklines. The primary component of the Santa Ana Restoration Project is a GRF which will provide control of the river hydraulics upstream of its location and also river bed control. The GRF was designed to: (1) Store more sand sediments at a stable slope for the current sediment supply; (2) decrease the velocities and

depths and increase the width in the river channel upstream; (3) be hydraulically submerged at higher flows while simultaneously increasing the frequency and duration of overbank flows upstream; (4) provide velocities and depths suitable for passage of the silvery minnow through the structure; and (5) halt or limit further channel degradation upstream of its location. The channel re-alignment involves moving the river away from the levee system and over the grade control structure. This activity involves excavation of a new river channel and floodplain. Another significant component of the Santa Ana Restoration project is riverside terrace lowering for the creation of a wider floodplain. The bioengineering and deformable banklines are also involved to assist in establishing the new channel bank and re-generating native species vegetation in the floodplain.

4. Temporary Channel to Elephant Butte: This Reclamation project involved the construction of a temporary channel through the delta area of Elephant Butte Reservoir to increase the efficiency of sediment and water conveyance. An additional project goal was to initiate some degradation of the river bed through the San Marcial Reach to increase overall channel capacity and potentially allow for higher peak releases from Cochiti Dam during subsequent spring runoff periods.

Measures were implemented to minimize impacts on the flycatcher and their associated habitats and to enhance local riparian conditions. These environmental actions included: Adding sinuosity to the temporary channel; constructing the channel with variable width; constructing low water crossings along the temporary channel to allow overbank flows to inundate existing native riparian vegetation and encourage native revegetation; a channel widening project in the southern reach of the Refuge to improve aquatic and riparian habitat; and creation of an inflow channel to a portion of the eastern floodplain north of Black Mesa to encourage sediment deposition and new habitat creation.

5. Creation of a Conservation Pool for Storage of Native Water in Abiquiu and Jemez Canyon Reservoirs and Release of a Spike Flow: This Corps project created space (100,000 ac-ft) in Abiquiu and Jemez Canyon Reservoirs to store Rio Grande Compact credit water for use in 2001, 2002, and 2003 for the benefit of listed species. The conservation pool was created with the understanding that the management of this water would be decided in later settlement meetings or during water operations conference calls. In addition, a supplemental release (spike) occurred in May 2001 to accommodate movement of sediment as a part of habitat restoration and construction on the Rio Grande and Jemez River on the Santa Ana Pueblo.

6. Bosque del Apache National Wildlife Refuge Conversion of Salt cedar to Native Habitats: The Refuge completed an intra-Service section 7 consultation in April 2000, on converting 1,845 acres of homogenous salt cedar *(Tamarix ramossima)* and mixed salt cedar/native bosque vegetative communities on the Refuge to native riparian, wetland,

and agricultural habitats. The proposal includes restoration of flycatcher habitat in the southern portion of the Refuge. The proposed restoration encompasses two to three areas of riparian/wetland habitat, each 60-acres or larger in size, to be restored to suitable native flycatcher breeding habitat.

7. Programmatic Biological Opinion on the Effects of Actions Associated with the U. S. Bureau of Reclamation's, U.S. Army Corps of Engineers', and non-Federal Entities' Discretionary Actions Related to Water Management on the Middle Rio Grande: The Service completed this biological opinion on June 29, 2001, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion had one RPA with several elements. These elements described many habitat improvements necessary to alleviate jeopardy to the flycatcher.

8. Biological Opinion and Conference Report on U.S. Bureau of Reclamation's Amended Water Management Operations on the Middle Rio Grande through December 31, 2002 On August 30, 2002, Reclamation submitted a request for reinitiation because they could not meet the flow requirements of the June 29, 2001, biological opinion. The Service completed this biological opinion on September 12, 2002, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion was an amendment to the June 29, 2001, programmatic biological opinion, which addressed Water Management Operations on the Middle Rio Grande through 2003. The amendment covered Reclamation's water management actions through December 31, 2002. The biological opinion had no RPAs. However, because of cool fall weather and early precipitation, the programmatic biological opinion of June 29, 2001, remained in effect.

Importance of the Action Area to the Survival and Recovery of the Species

The flycatcher recovery plan identifies five Recovery Units, the Basin and Mojave, Lower Colorado River, Upper Colorado River, Gila River, and Rio Grande. Flycatcher populations are not distributed evenly throughout these Recovery Units, with the majority of individuals found in the Coastal California, Lower Colorado, Gila, and Rio Grande Recovery Units (Appendix E, Table 1).

The Rio Grande Recovery Unit contains the eastern most population of flycatchers, and currently has 15% of known territories. Rio Grande Recovery Unit covers a major portion of the flycatcher's previous range. In order to be well protected against disease and catastrophe, the species should be well distributed geographically. The survival and recovery of the flycatcher is dependent on healthy, self sustaining populations of birds, which are able to exchange genetic information on occasion, and act as a source population should one area suffer significant losses

(Soule 1986). The loss of a major population within a Recovery Unit could have potentially significant effects to the surrounding Recovery Units if genetic information is lost, and a source population which has been supporting other sites, is extirpated.

Summary

The flycatcher's distribution and numbers have declined as a result of habitat loss, modification, and fragmentation. Known number of flycatcher pairs have increased throughout its range since the bird was listed in 1995, but still remain within the 500 to 1000 pairs estimated by Unitt (1987) (Appendix E, Table 1). Approximately half of all the known breeding pairs are found at three locations throughout the subspecies range (Cliff/Gila Valley, New Mexico, Roosevelt Lake and Gila/San Pedro river confluence, Arizona). Water diversions, agriculture return flows, flood control projects, development, livestock grazing, and changes in annual flows due to off stream uses of water have affected the ability of the aquatic habitats to support native fish, plants, and wildlife. Riparian habitats by nature are dynamic, with their distribution in time and space governed mostly by flood events and flow patterns. Current conditions along southwestern rivers and streams are such that normal flow patterns have been greatly modified, catastrophic flood events occur with greater frequency as a result of poor watershed conditions, stream channels are highly degraded, floodplains and riparian communities are reduced in extent, wildfires in riparian habitats are increasing, and the species composition of riparian communities are modified with exotic plant species. Habitat loss and fragmentation leads to increased brood parasitism and nest predation. These conditions have significantly diminished the potential for southwestern rivers and streams to develop suitable habitat for the flycatcher and for those habitats to remain intact and productive for nesting flycatchers.

IV. Effects of the Action

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

The primary effects of the proposed action on both the silvery minnow and the flycatcher are related to the management of flows in the Rio Grande. The proposed action is to manage water, in light of current drought conditions, in the most effective and efficient manner without precluding water management options in the future should drought conditions persist. Reclamation has estimated that due to the expected continuation of drought conditions, the proposed action will dewater a *minimum* of 105 river miles from May through early November in most years of the proposed action. More than 50 miles of stream would dry in the San Acacia Reach, approximately 40 to 50 miles would dry in the Isleta Reach, and about 6 miles is predicted to dry in the Angostura Reach. In the Angostura Reach, it is expected that outflow from Albuquerque's WWTP would keep approximately nine miles of the river wet, down to the Isleta Diversion Dam. The amount of river dewatering after October 1, depends on precipitation and the ability of the action agencies to lease available supplemental water.

The actual number of river miles dewatered, the frequency and duration of drying events, and the number of years within the 10-year life of the proposed action in which major drying events occur are dependent on many variables in addition to the proposed action including precipitation and other climactic conditions, the ability to store water in upstream reservoirs, and the availability of supplemental water for leasing. As of late January 2003, the state of New Mexico was experiencing drought conditions statewide affecting future spring runoff, soil moisture conditions, and streamflow outlooks. The long-term moisture deficits have led to extremely low soil moisture conditions that will significantly decrease spring runoff (Natural Resources Conservation Service 2003a). Forecasts predict that streamflow in the Rio Grande will be 70 percent of normal into Cochiti Lake and 65 percent of normal into Elephant Butte Reservoir (National Weather Service and Natural Resources Conservation Service 2003, Natural Resources Conservation Service 2003a, 2003b). "At an expected 65 percent runoff prediction, it will take more than several years to restore the normal lake level of nearly one million acre feet or better in the [Elephant] Butte [Reservoir] (Natural Resources Conservation Service 2003a)." In Attachment C of the March 2002 Amendment to the Biological Assessment for the Rio Grande and Low Flow Conveyance Channel Modification, Reclamation states that it would take 25 years of 100 percent normal runoff to bring Elephant Butte Reservoir up to full capacity. On the other hand, it would take 3 years of 200 percent of normal runoff to achieve the same goal (Reclamation 2002).

There is evidence to support that Pacific Decadal Oscillation (PDO) cycles, a measure of sea surface temperatures in the northern Pacific Ocean, mimic precipitation levels in the Southwest, specifically New Mexico (Liles 2000a, 2000b). The previous positive cycle (i.e., high levels of precipitation in New Mexico) occurred from 1977 to the late 1990's (Liles 2000a). Data indicates that the PDO cycle has been negative since 1998, suggesting the beginning of a long term dry precipitation cycle in New Mexico (Liles 2000a). Since 1998, long term precipitation affecting the hydrologic cycle has run in deficit. "The data would suggest, during an average 10-year period during the negative part of this [PDO] cycle, there would be 5 dry years, one wet year, and four normal years (Liles 2000a)." Overall, below average precipitation levels are expected to continue until at least 2010 and possibly until 2025 based upon this PDO cycle (Liles 2000a, 2000b). Consequently, it is reasonable to expect that over the next several years New Mexico will experience, at best, one wet year and several dry or average years, indicating that intermittency in the Rio Grande will most likely continue.

Changes in precipitation can have a disproportionate (e.g., nonlinear) change on streamflow in the Rio Grande and even small decreases in precipitation over the next ten years may lead to more drastic declines in discharge than are currently expected. Because of the current drought, the predicted below average years of precipitation until 2010 to 2025, and the disproportionate effect that low precipitation can have on discharge in the Rio Grande, Article VII may be in effect for the duration of this proposed action. According to Reclamation, the New Mexico Interstate Stream Commission (NMISC) and the New Mexico Drought Monitoring Workgroup (DMWG), it would take a well-above average amount of snowmelt runoff this winter to increase the amount of Rio Grande Project storage significantly enough to lift the Article VII restriction this year (Reclamation 2003, NMISC and DMWG 2003). This has not occurred. Under Article VII, native water can not be stored if less than 400,000 acre feet of usable Rio Grande Project water is available at Elephant Butte and Caballo Reservoirs. Under these conditions, it is expected that the snow melt hydrograph will peak higher but will be of shorter duration than if the water was being stored and released in a controlled manner. Consequently, it is expected that river drying will occur earlier in the year and last for a longer period of time than when the peak flow is created from reservoir releases and is lower in magnitude but longer in duration. Lack of water storage in the reservoirs will limit management options for the release of water for the benefit of silvery minnow.

Based on these climate factors and the potential for continued restrictions associated with Article VII of the Rio Grande Compact, it is the Service's opinion that "wet" or even "average" hydrologic scenarios resulting in continuous flows in the Middle Rio Grande are unlikely in most years of the 10-year proposed action. Although one wet year and four average years of precipitation would be expected during a ten-year cycle, the lingering effects of the current drought and the Article VII restrictions currently in place will likely result in dry hydrologic years. Thus, the following effects analyses are based on the likelihood of having "dry" hydrologic scenarios in most years of the proposed action.

Rio Grande Silvery Minnow

Direct Effects

During drought conditions, the proposed action is likely to impact a significant portion of the remaining wild population of silvery minnows in the Middle Rio Grande. Without precipitation or supplemental water, the proposed action will dewater at least 58 percent of currently occupied habitat. This conclusion is based on the fact that since the mid-1990s, silvery minnows have only been collected in the Angostura, Isleta, and San Acacia Reaches of the Middle Rio Grande. Silvery minnows have not been collected in the Cochiti Reach since 1994 (Platania 1995), because there has not been access to the Tribal lands north of the Angostura Diversion Dam to permit adequate sampling. Silvery minnows are assumed to exist within this short reach of river (22.9 river miles); however, no recent information is available to determine the exact status of the species in the Cochiti Reach. All recent available information on the silvery minnow population is from the Angostura, Isleta, and San Acacia Reaches, where the fish will be more adversely affected under the proposed action than the Cochiti Reach. Although there are no definitive population estimates for the silvery minnow, it is estimated through long-term population monitoring, that the majority of the silvery minnow population persists below San Acacia Diversion Dam (Dudley and Platania 2002). It is in this reach that the most extensive drying is predicted to occur.

If the current drought continues as predicted, it is highly likely that extensive stream drying will occur during the 2003 irrigation season, and possibly in 2004, and beyond. Stream drying causes direct mortality to silvery minnow when the pools in which they are trapped dry up. Like most living organisms, silvery minnow depend on oxygen to live. The oxygen they depend on is dissolved in the water. If the water dries up, the fish suffocate because they can not use oxygen present in air. Silvery minnow are unable to burrow and can not find refuge in the substrate. Mortality can occur before complete drying of the pools if the combination of dissolved oxygen level (too low) and water temperature (too high) becomes lethal. Changes in pH, salinity, carbon dioxide, and ammonia levels can make the fish more vulnerable to changes in dissolved oxygen or can be lethal on their own. Fish trapped in pools are easy prey for both terrestrial and avian predators and may also be eaten by predatory fish if they are trapped in the same pool.

It is difficult to predict the exact duration of channel drying or its extent. Obviously, the longer the period of intermittency and the greater the extent, the greater the magnitude of impact on the silvery minnow population. It is reasonable to predict that drying will occur after spawning. Typically, eggs and juvenile fish are more vulnerable to environmental extremes than adults (Hoar and Randall 1969). Consequently, drying events that occur after the spawn can potentially have a great impact on the reproductive success of the silvery minnow. Mortality of YOY is often high but with the added stress of environmental extremes, we predict that mortality of eggs and larvae trapped in isolated pools will be even higher than under natural conditions. Because the silvery minnow is a short-lived fish, poor reproductive success of one year class can have a major impact on the population. If there are consecutive years of intermittency with decreased reproductive success, the population can soon be reduced to extremely low levels.

Silvery minnow eggs and larvae are semibuoyant and are carried in the current. Although eggs will be captured for captive propagation efforts, a proportion of eggs and larvae will be entrained in diversion canals and into Elephant Butte Reservoir. The eggs and larvae will die in the reservoir from predation and lack of appropriate habitat. The degradation of silvery minnow habitat, which has led to a narrowing of the channel and lack of slack and back water habitats, results in fewer eggs and larvae being retained in the river and a greater proportion being transported into Elephant Butte Reservoir. Eggs and larvae that are entrained into diversion canals may die when they are carried in irrigation water onto agricultural fields. Individuals that do survive in the canals are isolated from the population in the river and are unlikely to contribute to the viability of the species.

Indirect Effects

The indirect effects of intermittency on silvery minnow have not been investigated but based on knowledge of stream ecology and fish biology, several indirect effects can be predicted. It is more difficult to predict how many silvery minnow may die or be harmed from indirect effects. Fish typically function best within a relatively narrow range of water quality characteristics such as water temperature, pH, dissolved oxygen, and salinity. When fish are subjected to conditions outside their preferred range it causes physiological stress (Schreck 1990). The longer the fish is subjected to unfavorable conditions the greater the stress (Barton et al. 1986). Consequences of physiological stress are typically a decrease in fitness (lowered reproductive success)(Donaldson 1990) and an increased susceptibility to disease (Anderson 1990). Fish can be afflicted by viral, bacterial, and fungal infections and internal and external parasites. Disease can cause death or lead to decreased fitness. When fish are trapped in isolated pools and the water quality of the pools deteriorates, the fish become increasingly stressed. If continuous flow is restored before the fish dies, the fish may survive but eventually succumb to disease or produce fewer (or smaller) eggs as a consequence.

In a flowing river, food resources and nutrients are carried downstream continuously. When the flow is interrupted, this transport of material is stopped. Nutrient cycling and nutrient spiraling systems are disrupted. How long it takes for the system to regain its equilibrium is unknown. Possible consequences of this disruption of nutrient cycles are changes in the amount and quality of food available to silvery minnow. If less food is available or if it is of lesser quality it could effect the growth, condition, and fitness of silvery minnow. Consequently, fewer, or smaller (less fit), eggs may be produced. If intermittency occurs several years in a row, the net effect would be the production of fewer silvery minnow.

It is anticipated that salvage of silvery minnows will occur once intermittency begins. It is unknown what effect salvage operations have on the survival of silvery minnow. Salvage operations begin once the fish are trapped in isolated pools. Water quality conditions can deteriorate quickly, stressing the fish. The fish are then seined, handled, transported, and introduced into a new location. Although cyprinids in general are a hardy fish, it is unknown if the stress of salvage operations effects their survival. However, refinements in silvery minnow salvage and rescue protocol have reduced handling and transport mortality (Smith and Muñoz 2003). Sigismondi and Weber (1988) found that handling lengthened the time required for chinook salmon to seek cover and that each successive handling experience added to the time needed to reach cover. We have no data on survival in the wild after salvaged minnows are released.

Silvery minnows and their congeners have been handled and transported for at least 10 years (Platania and Altenbach 1998). Reproductively active silvery minnows were collected from the Rio Grande as early as 1993 to document their reproductive behavior and egg type (Platania and Altenbach 1998). Platania and Altenbach (1998) also collected numerous other species of cyprinids from the Pecos river to determine their reproductive biology. During this study, fish were inoculated with hormones to induce spawning, which proved successful. Since that time the same methods have been used and improved to increase the success of spawning silvery minnows in captivity (C. Altenbach, City of Albuquerque, 2002).

Since 1996, silvery minnows have been salvaged during drying events and transported to flowing water in an attempt to minimize mortality. Significant steps have been made within the last 7 years to improve the survivability of salvaged silvery minnows during collection, transport, and release (Smith and Muñoz 2002). Beginning in 1998, the Service developed and has followed specific protocols for handling and transporting silvery minnows during river intermittency and other salvage operations (Jude Smith, Pers Comm Service 2002). Since that time, improvements have been made in transportation of silvery minnows following specific protocols (Smith and Muñoz 2002).

Survivability of silvery minnows after handling has been documented since 2000. In 2000, two sampling events occurred during the spring to collect adult silvery minnows for captive spawning. During these two events the Service in conjunction with the City of Albuquerque collected approximately 198 adult silvery minnows during low flows near San Marcial. Due to unavoidable circumstances, collections were made in the mid-morning during the first collection event (Smith 2000). Ambient conditions were around 30 degrees Celsius and water temperatures ranged from 16 to 20 degrees Celsius (Smith 2000). Even under harsh collecting conditions, we experienced no initial mortality. After time only about 5 percent of the silvery minnows perished and that mortality was likely an artifact of the induced spawning (C. Altenbach per communication).

Although some success has been made in the transport of fish to propagation facilities, other attempts have had lower than desired out-comes. In June of 2001, an attempt to salvage YOY silvery minnows was made by the Service. During this attempt, approximately 5000 YOY silvery minnows were captured near San Marcial and transported to the NMFRO propagation facility. Handling protocol was strictly followed during this salvage attempt; however, these fish experienced high mortality levels (Brooks 2001). No firm cause of the high mortality rate was determined. It was speculated that collection conditions caused the fish to become overly stressed. Young fish are not as resistant to stress as adults, so it likely that more care should be taken when transporting these young fish from the wild. It is likely, that the mortality can be decreased when moving YOY by using oxygenated plastic bags, rather than the large distribution truck, used in 2001.

In the worst case scenario, the primary source of persistent water in the Middle Rio Grande may be from effluents from WWTPs and from irrigation return flow. These sources of water will be of a lesser quality than would be found in fully connected, flowing river. Unless a spill of toxic material or a peak in ammonia or chlorine discharge happens to occur at the time when silvery minnow are depending on these water sources, it is unlikely that direct mortality will occur. However, because of the higher levels of nutrients, total dissolved solids, heavy metals, semi-volatile compounds, volatile compounds, pesticides, and other compounds found in sewage effluent, it is highly likely that these multiple compounds may cumulatively have a negative impact on the health, fitness and condition of the silvery minnow living in this water (Beyers et al. 1999, Buhl 2002)

Because conditions in the river are expected to be unfavorable for the survival of silvery minnow, more effort is being placed on the capture of eggs for captive propagation. Great care must be exercised as dependence on captive propagation increases. The location (large and small scale) and timing of egg capture, and method of rearing can all effect the genetics and long-term effectiveness of captive propagation. For instance, if the eggs for propagation are all collected during the peak spawning period (as opposed to eggs produced during small, natural flood events), managers may unwittingly be selecting for fish that only spawn in a narrow time frame. This could lead to propagated fish that have less reproductive plasticity, and in the long run could lessen their ability to survive under natural conditions. Because the number of wild fish is currently at the lowest level recorded, the population is experiencing a genetic bottleneck, reducing the amount of genetic variability available for the broodstock. In addition, the captive reared fish can have a major influence on the population genetics of the silvery minnow because of the large number of fish that are being planted. As Minckley (1995) pointed out there is a distinction between the "prevention from extinction" and the "maintenance of evolutionary potential." The latter considers the long term future of the species and its ability to evolve to changing conditions. While captive propagation may ensure the short term survival of silvery minnow, the long term effect of the program is unknown, and data are still being collected.

Evidence suggests that silvery minnows spawn to a lesser extent during monsoonal peak flows Smith (2002). Eggs and larvae that are produced from spawning efforts tied to monsoons will likely perish during subsequent river drying, eliminating these propagules from the population.

Effects on Designated Critical Habitat

The proposed action will adversely affect three of the four primary constituent elements of designated critical habitat for the silvery minnow. These three elements require water to provide the essential habitat necessary to ensure the conservation of the silvery minnow. The first primary constituent element provides water of sufficient flows to reduce the formation of isolated pools. The second primary constituent element provides low velocity habitat necessary for development and hatching of eggs and the survival of the silvery minnow from larvae to adult. The fourth primary constituent element provides protection from degraded water quality conditions, such as, the increasing water temperatures, pH, or decreasing dissolved oxygen found in isolated pools during river drying events (USFWS 2003).

Under the proposed action, at least 105 river mi (169 km) will be dewatered out of the 157 river mi (252 km) proposed as critical habitat. This means that at least 67 percent of designated critical habitat will lack 3 of the 4 primary constituent elements that provide the essential habitat necessary to ensure the conservation of the silvery minnow. Furthermore, the effects of this action may not be readily apparent or quantifiable within the duration of this action and may extend beyond rewetting of the designated critical habitat. Such effects may include, but are not limited to: Reduction in the productivity of the dewatered and rewet reaches, which may limit or severely reduce food for the silvery minnow; alteration or elimination of debris piles or other habitat structures necessary to the silvery minnow during the winter; and possible lowering of the ground water table, necessitating increased quantities of water for rewetting the dewatered reaches and recovery of continuous flow.

Southwestern Willow Flycatcher

Effects to the flycatcher are addressed in the following pages by first analyzing the impacts to the known 2002 territories, and second the effects to the riparian system along the Rio Grande. It should be noted, that given the life span for this consultation, the indirect effects (effects to the riparian system) will most likely be highly significant and will not be measurable until a few years into the consultation period.

Direct Effects

The proposed action is likely to contribute to river drying in 43 active flycatcher territories. Because drying is likely to occur early in the breeding season, flycatchers using those territories will be forced to seek alternative sites for territory establishment. If flycatchers do not abandon territories that have dried, food availability may be limited, thereby reducing nesting success. In addition, drying of large portions of the Rio Grande for prolonged periods is likely to result in reduction of suitable flycatcher habitat within the Rio Grande Recovery Unit (as designated in the Southwestern Willow Flycatcher Recovery Plan).

Under Reclamation's proposed action, drying could occur as early as late April or early May. This time period can be critical to flycatchers attempting to establish territories and nest sites. For flycatcher territory selection, a number of habitat characteristics have been identified as important factors (USFWS 2002). One of these factors is the availability of standing water, and/or moist soils, during the breeding season. If nest sites are dry early in the breeding season, those sites may be abandoned before completion of the breeding cycle (Johnson et al 1999). If flycatchers do establish territories and insect availability is reduced due to drying, then reduced food supply may force egg abandonment or chick starvation. Incubation of eggs requires that the male flycatcher feed the female on the nest for much of the day and provide sufficient food for the incubating female and for himself. After eggs hatch, energetic requirements increase, as both adults must feed the young. Feeding demands from the young increase for the first week after hatching, then decrease until fledging at approximately day 12 (Sedgwick 2000).

If occupied sites become less desirable due to river drying, and there is no suitable habitat nearby, the birds in those sites may be forced to disperse in search of new territories, which may expose individuals to increased predation as they navigate through new areas. Additionally, the increased energetic cost of locating and traveling to suitable habitat may impact the fitness and reproduction of adult flycatchers. If individuals do find suitable habitat, it is likely that the new site will be colonized by only one, or few, individuals. Sites with few individuals are more susceptible to extirpation (Gilpin and Soule *in* Gilpin 1986). Since 1993, 65 of the 221 known Flycatcher breeding sites have been extirpated and 63 of those 65 sites were occupied by fewer than 5 individuals (Sogge et al. 2002).

Flycatchers may also abandon sites if they are dry in May and early June, during the birds' pair bonding and early nesting chronology (Johnson et al. 1999). Once flycatchers have invested their energy laying eggs (usually in early June along the affected reaches of the Rio Grande), the birds would most likely attempt to incubate those eggs and raise the young. Lack of water in established territories may reduce insect populations, limiting food supplies needed to produce eggs or feed young and potentially reducing fledgling success. Such an event occurred in 1996, when the San Marcial area was dry in April and remained dry until late June. Based on surveys, only one nesting attempt was located and it failed (Johnson et al. 1999).

Diversion of native flows into irrigation canals will alter the distribution of water in the river. Flycatcher territories that are below the diversion dams and upstream from irrigation returns (n = 35) would be the most severely affected by drying (Appendix E, Table 10). However, flycatchers that reside below the irrigation returns (n = 18) would be negatively affected by the lack of irrigation return flows if irrigation terminates during the breeding season. If irrigation season is shortened significantly and return flows cease in May, then the flycatchers may abandon territories and any reproductive effort would be lost.

The severity of drying in established territories is dependent on when the site dries (the date when soils are no longer saturated) and the number of breeding seasons the drying is repeated. Territories in the Isleta and San Acacia Reaches (Belen, Sevilleta/La Joya, San Acacia to BDANWR, and BDANWR sites listed above) would be most severely impacted by the proposed action because these reaches are affected by the Isleta Diversion Dam and San Acacia Diversion Dam, where irrigation flows are diverted from the river. Of particular concern are the sites located in Sevilleta (SV-09) and La Joya Refuges (SV-03), which produced 12 territories and 13 nests, respectively, in 2002, and could be subjected to drying during the life of the proposed action.

In 2002, there were four territories identified in the reach from San Acacia to the Refuge (LF04, LF-08, LF-33, LF-43a) and three territories identified near the northern Refuge boundary (BA-06N). These seven territories were thought to be occupied by single males, were located along the river, and would be subject to drying under the proposed action. We anticipate that drying in these areas is likely to render the habitat unsuitable for breeding (as described above) and may induce these individuals to seek alternative breeding locations.

In the San Marcial Reach (south boundary of the Refuge to the headwaters of Elephant Butte Reservoir), 62 territories were located in 2002. Two sites (LF-22 and LF-21) re located just south of the Bosque Del Apache Refuge boundary along the river and consisted of 3 territories and one nesting attempt that apparently failed. These sites were located just downstream from the South Boundary Pumps, which are used to pump water from the LFCC back into the Rio Grande. In 2003, under the proposed action, these pumps will likely be shut off by June. These sites may dry if pumping is discontinued.

Of the 62 territories found in 2002, between the south boundary of the Refuge and Elephant Butte Reservoir, the 19 territories located along the Rio Grande (LF-12,14,16, 18, 21, 22, 31, and DL-3) are likely to be subject to drying in the early part of the breeding season, increasing the potential of nest abandonment, and increasing energetic costs to adult flycatchers as they search for new territories. Increased energetic costs and susceptibility to predation may result in mortality or decreased reproductive success.

The biological assessment states that the territories along the LFCC will not dry, and that the flycatcher territories supported by the breach in the LFCC will not be adversely affected. We agree with this determination. The potential for the LFCC to go dry is very remote and is therefore discountable. Should the LFCC become dry (cfs = 0 at the breach above LF-17) at any time during the life of the proposed action, Reclamation shall reinitiate this consultation.

Indirect effects

Indirect effects from water operations include reduction of suitable habitat along the Rio Grande during the 10-year life of the project and beyond. Flycatcher habitat is ephemeral. Areas which are currently occupied may not be suitable in future years as the trees mature and the habitat begins to thin. Having areas of riparian vegetation along the Rio Grande that are maturing into suitable habitat while other areas are reaching a maturity level that makes them unsuitable for flycatchers is crucial to the long-term survival of the species. River drying in May and June in any year of the proposed action may kill riparian vegetation that currently supports flycatcher territories. Drying may also kill vegetation that has the potential to become suitable habitat. Reductions in overbank flows, as described in the biological assessment, will likely reduce the quantity and quality of suitable flycatcher habitat along the Rio Grande. Without sufficient overbank flooding, flycatcher habitat development in the Rio Grande will be severely limited even beyond the life of the project. The degree to which flycatcher habitat is reduced will depend on several variables, including the amount dried, the length of time they are dry, and the number of years in which these drying events occur. The reduction in suitable habitat available to the flycatcher would, in turn, limit the potential for population growth in the Rio Grande or reverse current positive population trends.

Lack of overbank flooding in spring, lack of sediment for seed germination, and water management between Cochiti Reservoir and the headwaters of Elephant Butte Reservoir have resulted in a monotypic age-class structure of native vegetation, particularly older cottonwood trees, and increased encroachment of exotic plant species, such as salt cedar and Russian olive (Howe and Knopf 1991, Crawford et al. 1993). Furthermore, the lateral extent of suitable habitat for the flycatcher is constrained by water operations that limit overbank flooding to sites located close to the river's edge, resulting in a relatively narrow strip of suitable nesting habitat for flycatchers. The narrowness of suitable riparian vegetation increases the risk to flycatchers of adverse effects from flooding, predation, parasitism, and other disturbances. Stromberg (1993) found that the width of riparian vegetation communities and their biomass increases with mean and median annual flow volume and drainage size in alluvial river channels. The flycatcher depends on large patch sizes of riparian vegetation with adequate insect food supply to raise young into July, August, and September.

El Vado Reservoir Storage

With Article VII in effect, only water for the six Middle Rio Grande Pueblos will be stored in El Vado. The spring runoff will be allowed to flow down the Rio Chama and Rio Grande to Elephant Butte. In theory, this restriction in storage would have a beneficial effect to flycatcher habitat along these rivers since more overbank flows would be expected during the spring runoff. Irrigation diversions are not constrained by Article VII; however, under Article VII, storage water for irrigation may not be available. Therefore, it is likely that the amount of water diverted at the various irrigation diversion dams will equal the capacity of the irrigation diversions so that irrigators can maximize water use when water is available. In years where spring runoff is high, the effects of irrigation diversions may not be significant. In such years, sufficient overbank flooding will occur below the irrigation diversion dams; however, during years when there is little runoff the irrigation diversions may appreciably reduce runoff flows, including elimination of overbank flows.

When Article VII is not in effect, storage of native water in El Vado Reservoir typically occurs during spring runoff and summer rain events. This storage results in a decrease in the amount of water that is passed through Abiquiu and Cochiti Reservoirs to the Middle Rio Grande below Cochiti Dam. Depending on the amount of water already stored and the magnitude of spring runoff, El Vado Reservoir may capture part or all of the flow associated with spring runoff and rain events. For example, the volume of spring runoff on the Rio Chama in 2000, was very low due to drought conditions. The available storage space in El Vado Reservoir was sufficient to capture all of these flows (USGS 2002), resulting in low flows in the Rio Grande.

Spring runoff into the Rio Chama is one component of the overall runoff on the Middle Rio Grande below Cochiti Dam. Runoff into the mainstem of the Rio Grande is the other significant source of water in the river during this time period. The relative volume of spring runoff contributed by the Rio Chama and the mainstem of the Rio Grande is largely dependent on local snowpack conditions. Thus, the relative significance of runoff flows from the Rio Chama on the Rio Grande is also dependent on the volume of runoff in mainstem flows. In the last 20 years, the Rio Chama contributed about 30 – 45 percent of runoff flows in the Middle Rio Grande each year. In years with high mainstem runoff, an increased volume of Rio Chama runoff flow could be stored without adversely impacting the flycatcher downstream. However, in years with little to no peak flow input from the mainstem Rio Grande, the impacts of storing Rio Chama runoff flows at El Vado Reservoir may be more severe.

Effects of reducing peak flows in the Rio Grande by storing native flows in El Vado Reservoir during spring runoff include: (1) Reduction in overbank flooding and associated loss of low velocity habitat used by flycatchers, and (2) continued narrowing of the Rio Grande channel downstream due to the long-term reduction in channel-forming discharge. Channel narrowing reduces the availability of shallow, low velocity habitat that is needed to create/maintain suitable flycatcher habitat. Flycatcher territories on the Rio Grande upstream of the confluence of the Rio Chama would be unaffected by operations at El Vado Dam and Reservoir.

Reduction in overbank flooding in the Rio Chama and Rio Grande, due to the storage of peak native flows in El Vado Reservoir, will adversely affect flycatcher nest establishment and the rearing and fledging of juveniles at sites throughout the action area. Overbank flooding associated with spring runoff and summer rain events is an important component of flycatcher nesting success. The presence of overbank flooding to provide low-velocity flows in flooded vegetation is a key component in the physical structure selected as nest locations by flycatchers. Reduction in overbank flooding adversely affects the maintenance and establishment of riparian vegetation downstream. High discharges are important for the creation and maintenance of the riparian ecosystem, and specifically, migratory and nesting habitat for flycatchers. Also, the rate and timing of flows augmented by spring runoff is important to recruitment of native cottonwood and willow vegetation utilized by flycatchers for migrating, nesting, and foraging. Storage in El Vado may restrict the development of flycatcher habitat from El Vado Dam to the confluence with the Rio Grande.

Diversion Dams

When Article VII is in effect, water for irrigation will be available mostly from the spring runoff and irrigators will likely divert as much water as possible during this time. Diversion of water at the dams reduces the flow in the river under most operational scenarios, however, during dry hydrologic years, these reductions are more likely to result in adverse effects to flycatchers and their habitat.

Flows in the Rio Grande above the confluence of the Rio Chama are unregulated and are not significantly influenced by any Reclamation water operation. Thus, future baseline conditions and the potential effects of Reclamation's actions on flycatchers in the Velarde Reach will be addressed only in the context of river maintenance activities.

Corps Discretionary Actions

Flood Control Operations

When combined inflows to Cochiti and Jemez Canyon dams exceed 7,000 cfs, the Corps will only release up to 6,000 cfs from Cochiti Dam (or a combined release from Cochiti and Jemez Canyon Dams), even though the current safe channel capacity at Albuquerque is 7,000 cfs. The channel constriction (5,000 cfs capacity) at the San Marcial Railroad Bridge downstream limits the release to 6,000 cfs. This reduces the amount of overbank flooding that can occur and, thus, may reduce formation of flycatcher habitat.

Summary

The Rio Grande Recovery Unit contains the eastern most population of flycatchers, and currently has 154 (15% of total known) territories. The proposed action will directly affect approximately 43 territories (28% of territories in the Recovery Unit, and 4.5% of total known territories). The survival and recovery of the flycatcher is dependent on healthy, self sustaining populations of birds, which are able to exchange genetic information on occasion, and act as a source population should one area suffer significant losses (Soule 1986). The proposed action may result in a significant loss to the flycatcher population within the Rio Grande Recovery Unit. The loss of a major population within a Recovery Unit could have potentially devastating effects to the surrounding Recovery Units if genetic information is lost, and a source population which has been supporting other sites, is extirpated.

The proposed action is likely to jeopardize the continued existence of the southwestern willow flycatcher. The Rio Grande Recovery Unit contains approximately 154 flycatcher territories (Appendix E, Table 3). The action area for the proposed project contains 123 flycatcher territories, 99 in the Middle Rio Grande Subunit and 24 in the Upper Rio Grande Subunit. Of these, approximately 43 may be dried by the proposed action (Appendix E, Table 10). In 1996, the San Marcial stretch was dewatered beginning in April and flycatchers did not breed successfully. Flycatchers may not nest in otherwise appropriate habitat when the habitat is dewatered. When dewatering occurs, the forage base for flycatchers is reduced and the habitat may be damaged depending on the amount and extent of dewatering. When this occurs, the flycatchers may go elsewhere to nest or may not breed that year. While we do not know the impact of such temporary habitat loss on subsequent breeding seasons, if the river remained dry during consecutive years, the quality of the nesting vegetation/habitat would decline and flycatchers may permanently abandon this breeding/nesting area. Loss of these territories means that approximately 43 percent of flycatcher territories within the Middle Rio Grande Subunit, and 28 percent of territories for the entire Recovery Unit would be dewatered, and would be vacated, jeopardizing the Rio Grande population, and thus the persistence of the species. Impacts to suitable of potential flycatcher habitat may be expected from long-term dewatering.

River Maintenance

Rio Grande Silvery Minnow and Southwestern Willow Flycatcher

All proposed river maintenance activities occur within the historic range of the silvery minnow and flycatcher. However, due to the recent extirpation of the silvery minnow upstream of Cochiti Reservoir and downstream of Elephant Butte Reservoir, river maintenance projects upstream of Cochiti Reservoir and below Elephant Butte Reservoir will not directly affect the silvery minnow. However, river maintenance projects that promote channelization in these reaches could adversely affect the flycatcher and its potential habitat.

River maintenance projects vary in duration, depending on the scope, immediate need, time of year, river flow conditions, and project location. In some cases, such as the Santa Ana Project referenced in the assessment, river maintenance projects may be completed in phases over several years. Some river maintenance projects may last only a few days. These two types of projects may affect many miles of river or only a few hundred feet.

The assessment does mention, in a broad sense, the number and location of potential river maintenance projects; however, it does not provide exact locations. The assessments indicates that a total of 57 projects could occur in approximately 226 river miles. The effects of each project are likely to vary. Each reach defined in the assessment is geomorphically and hydrologically different. Each maintenance/restoration project should be consulted on prior to construction, and should tier to this programmatic biological opinion.

As documented in the assessment, channel narrowing has occurred at an alarming rate in all reaches. There has been at least a 40 percent reduction in the active channel over the last 80 years, with the channel shrinking from 1400 feet to 600 feet in width in many reaches of the Rio Grande. It has been hypothesized that this channel narrowing has accelerated the decline of silvery minnow populations (USFWS2000). Channel narrowing or channelization was a goal of many early river engineering projects. These projects were initiated in the 1930s and 1950s for flood control and improved water deliveries. Early river maintenance projects included levees, jetty jacks, rip rap, and other non-permeable engineering techniques. These and other river engineering methods are proposed in the assessment and will adversely affect the silvery minnow and its habitat and the flycatcher by reducing overbank flooding and facilitating channel narrowing.

Although channel narrowing may not be the only factor contributing to the decline of the silvery minnow in these reaches, it may be one of the most noticeable factors and can be repaired. Any river maintenance project that facilitates channel narrowing, such as those outlined in the assessment as river engineering projects, will adversely effect both the silvery minnow and flycatcher. The adverse impacts to both listed species include, but are not limited to, controlling and limiting overbank flooding and reducing channel width and reducing the amount of peak discharge needed to produce overbank flooding and channel widening.

Habitat restoration and bioengineering projects would have positive effects on both the silvery minnow and flycatcher. Although unequivocal analysis cannot be made on the effects of each proposed action, the general conceptual methods proposed will have beneficial effects for listed species. General improvements to the river and riparian areas by habitat restoration and bioengineering projects, planned in consultation with the Service, include the following:

- re-connectivity of floodplain to the river with overbank flows;
- improved riparian habitat with removal of invasive non-native vegetation that has been demonstrated to be unsuitable for, or unoccupied by flycatchers, in conjunction with reintroduction of native vegetation and periodic inundation of riparian areas; and
- widening of the river channel to allow active geomorphological river conditions which produce natural aquatic habitats conducive to native fish and riparian habitats.

Adverse effects of river maintenance include, but are not limited to, the following:

- localized dewatering of the river by redirecting water flows to perform necessary work may adversely affect the silvery minnow and its habitat and may adversely affect the flycatcher;
- introduction of non-native types of substrate, *i.e.*, large boulders, rip rap, non-erodible materials, which will modify the channel making it unsuitable for silvery minnows and making the floodplain unsuitable for flycatchers;
- removal of native and some non-native species of vegetation from the action area could adversely affect the flycatcher by destroying potentially suitable habitat; and
- increased human activities in the project area during construction may adversely affect the flycatcher if construction occurs during the breeding or nesting season.

Increased human access to areas once relatively remote may adversely affect flycatchers, depending on proximity of activities and the potential for human-caused fires and wood cutting. Vandalism and human-caused fires can also increase negative impacts to native riparian vegetation. Heavy equipment use in the action area for an undetermined amount of time may impact the flycatcher if used during the breeding or nesting season. The potential exists for fuel or oil spills causing contamination in the river, adversely affecting the silvery minnow and its habitat. The construction of borrow pits and spoils will adversely affect the flycatcher if placed near potentially suitable habitat by limiting potential occupation of breeding territories.

V. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects include:

• Increases in development and urbanization in the historic floodplain that result in reduced peak flows because of the flooding threat. Development in the floodplain makes it more difficult, if not impossible, to transport large quantities of water that would overbank and create low velocity habitats that the silvery minnow prefers. Development also reduces overbank flooding favorable for both the silvery minnow and the flycatcher.

• Increased urban use of water, including municipal and private uses (e.g., Intel at Rio Rancho). Further use of surface water from the Rio Grande will reduce river flow and decrease available habitat for the silvery minnow and flycatcher.

• Contamination of the water (*i.e.*, sewage treatment plants, runoff from feed lots, dairies, and residential development). Potential decrease in surface water (by municipal use) will lower the dilution factor for contaminants, and will result in a decrease in water quality, which will adversely affect the silvery minnow and its habitat.

• Gradual change in floodplain vegetation from native riparian species to non-native species (*i.e.*, salt cedar) that result in narrow, deep aquatic habitat. The silvery minnow prefers shallow, low velocity habitats. Therefore, there will be less habitat available for the silvery minnow. The flycatcher will be adversely affected by the increased risk of wildfire.

• Intentional and unintentional destruction and fragmentation of flycatcher habitat, such as by human-caused wildfires, trash dumping, and cutting and removal of native riparian vegetation.

• Private, local, and State grazing actions that create abundant brown-headed cowbird foraging opportunities, thereby increasing the likelihood of brood parasitism on local flycatcher populations.

• Future local actions include farming and grazing in the Middle Rio Grande floodplain and terraces, and water removal from the river. Livestock grazing may adversely impact flycatchers by destroying habitat, negatively impacting native vegetation, and by attracting brown-headed cowbirds. Other human activities that may adversely impact the silvery minnow and flycatcher by decreasing the amount and suitability of habitat include dewatering the river for irrigation; increased water pollution from non-point sources; adverse effects from increased recreational use, suburban development, and removal of large woody debris; and logging.

• Increases in private development and urbanization in the historic floodplain that reduce and fragment riparian habitat for the flycatcher on the landward side of the levee, while increasing pressure on riparian habitat and wildlife within the bosque.

The Service anticipates that these types of activities will continue to threaten the survival and recovery of the silvery minnow and flycatcher by reducing the quantity and quality of habitat through continuation and expansion of habitat degrading and destroying actions.

VI. Conclusion

The Service has analyzed the full spectrum of water management options described in the February 19, 2003, final biological assessment. We have analyzed the threats to the species and have developed alternatives based on biological needs of the species, independent of sources of water and discretionary authority.

After reviewing the current status of the silvery minnow and flycatcher, the environmental baseline for the action area, including current and expected drought conditions, the effects of the proposed water operations and river maintenance activities, and the cumulative effects, it is the Service’s biological opinion that water operations and river maintenance of the Middle Rio Grande, as proposed in the February 19, 2003, biological assessment, are likely to jeopardize the continued existence of the silvery minnow and the flycatcher and adversely modify critical habitat of the silvery minnow. Critical habitat for the flycatcher is not currently designated in the action area, so none will be affected.

Silvery Minnow

The silvery minnow now occupies less than five percent of its historic range and the entire extant population now exists within the action area. Entrainment at the diversion dams results in death of silvery minnows by stranding eggs, larvae, and adult fish on irrigated agricultural fields. The diversion dams block upstream passage by silvery minnows and therefore prevent repopulation of areas upstream of the dams. Dam operations result in reduced sediments and water temperatures that cause habitat degradation and loss. Dewatering of river reaches traps and subsequently kills silvery minnows in isolated pools. Dewatering decreases water quality and quantity and availability of forage items, and removes shelter. In a worst case scenario (severe drought), the majority of the Angostura, Isleta, and San Acacia Reaches could be dewatered, killing a significant number of silvery minnows. In years that Article VII is in effect, which could be most years of the proposed action, river drying could occur to an extent that would result in the loss of 90 to 100 percent of all silvery minnows.

The remaining population of the silvery minnow is restricted to five percent of its historic range. Every year since 1996, there has been at least one drying event in the river that has further reduced the silvery minnow population. Mortality estimates for the April 1996, dewatering event have been as high as two-thirds of the silvery minnows present in the San Acacia Reach, which would represent 47 percent of the total range-wide population. The consequences of the 1996 mortality event are currently unknown, but the species' near-term status, and likely long-term recovery potential were adversely affected. Dead silvery minnows have been documented in a dry riverbed in 1999, 2000, 2001, and 2002.

Data collected during the summers of 2000, 2001, and 2002 indicate a near-absence of Age 0 silvery minnows in the Middle Rio Grande, suggesting that the population has dramatically decreased since 1999. There was a slight increase in silvery minnow abundance in the Angostura and Isleta Reaches in 2001; however, these slight gains were lost in 2002. The population is unable to expand its distribution, because three diversion dams currently block upstream movement and Elephant Butte Reservoir blocks downstream movement.

Water withdrawals from the river and water releases from dams may severely limit the survival of silvery minnows. The consumption of groundwater and surface water for municipal, industrial, and irrigation uses continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow. However, under State law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system. The City of Albuquerque, for example, has been offsetting their surface water depletions with 60,000 ac/ft per year. The combined effect of water withdrawals and the drought mean that discharge from WWTPs and irrigation return flows will have greater importance to silvery minnow and a greater impact on water quality. Lethal levels of chlorine and ammonia have been released from the WWTPs in the last several years. In addition, a variety of organic chemicals, heavy metals, nutrients, and pesticides have been documented in the river and contribute to the overall degradation of water quality.

<u>Designated Critical Habitat for the Silvery Minnow</u>

In light of current and expected drought conditions, the proposed action will adversely affect three of the four primary constituent elements of designated critical habitat for the silvery minnow. These three elements require water to provide the essential habitat necessary to ensure the conservation of the silvery minnow. The first primary constituent element provides water of sufficient flows to reduce the formation of isolated pools. The second primary constituent element provides low velocity habitat necessary for development and hatching of eggs and the survival of the silvery minnow from larvae to adult. The fourth primary constituent element provides protection from degraded water quality conditions, such as, the increasing water temperatures, pH, or decreasing dissolved oxygen found in isolated pools during river drying events (USFWS2003).

As described in Reclamation's Biological Assessment, at least 105 river mi (169 km) will be dewatered out of the 157 river mi (252 km) proposed as critical habitat. This means that at least 67 percent of designated critical habitat will lack 3 of the 4 primary constituent elements that provide the essential habitat necessary to ensure the conservation of the silvery minnow. Furthermore, the effects of this action may not be readily apparent or quantifiable within the duration of the proposed action and may extend beyond rewetting of the designated critical habitat. Such effects may include, but are not limited to: Reduction in the productivity of the dewatered and rewet reaches, which may limit or severely reduce food for the silvery minnow; alteration or elimination of debris piles or other habitat structures necessary to the silvery minnow during the winter; and possible lowering of the ground water table, necessitating increased quantities of water for rewetting the dewatered reaches and recovery of continuous flow.

<u>Southwestern Willow Flycatcher</u>

The proposed action will directly affect approximately 43 territories (28% of territories in the Recovery Unit, and 4.5% of total known territories), and may result in a significant loss to the flycatcher population within the Rio Grande Recovery Unit. The loss of a major population within a Recovery Unit could have potentially devastating effects to the surrounding Recovery Units if genetic information is lost, and a source population which has been supporting other sites, is extirpated.

In 2002, the Rio Grande Recovery Unit contained approximately 154 flycatcher territories (Appendix E, Table 3). The action area for the proposed project contains 123 flycatcher territories, 99 in the Middle Rio Grande Subunit and 24 in the Upper Rio Grande Subunit. Of these, approximately 43 territories may be dried by the proposed action (Appendix E, Table 10).

In 1996, the San Marcial stretch was dewatered beginning in April and flycatchers did not breed successfully. Flycatchers may not nest in otherwise appropriate habitat when the habitat is dewatered. When dewatering occurs, the forage base for flycatchers is reduced and the habitat may be damaged depending on the amount and extent of dewatering. When this occurs, the flycatchers may go elsewhere to nest or may not breed that year. While we do not know the impact of such temporary habitat loss on subsequent breeding seasons, if the river remained dry during consecutive years, the quality of the nesting vegetation/habitat would decline and flycatchers may permanently abandon this breeding/nesting area. Loss of these territories means that approximately 43 percent of flycatcher territories within the Middle Rio Grande Subunit, and 28 percent of territories for the entire Recovery Unit would be dewatered, and would be vacated, jeopardizing the Rio Grande population, and thus the persistence of the species. Recovery of the subspecies in the Rio Grande Recovery Unit is dependent on attainment of goals for suitable, protected habitat and number of territories within the Middle Rio Grande Subunit. Impacts to suitable and potential flycatcher habitat may be expected from long-term dewatering. Additionally, proposed water operations and river maintenance may not include a channel forming discharge to reverse incisement of the river channel. The incised channel will continue to limit the formation and maintenance of flycatcher habitat in the action area, thereby jeopardizing the recovery of the Rio Grande population.

VII. Reasonable and Prudent Alternative

Regulations (50 CFR §402.02) implementing section 7 of the ESA define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that: (1) Can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) would, the Service believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

The Service has developed the following reasonable and prudent alternative to the March 1, 2003, through February 28, 2013, water operations and river maintenance proposal that we believe will avoid jeopardy to the silvery minnow and flycatcher. Implementation of elements of the reasonable and prudent alternative that involve access to Indian Pueblo or Tribal lands requires the consent of the affected Indian Pueblo or Tribe. If the Federal agencies implement elements of the reasonable and prudent alternative that may affect Indian Pueblo or Tribal trust resources, then government-to-government consultation is required.

The Service and parties to the consultation have been engaged in ongoing discussions to examine all possible water management options to benefit the silvery minnow and the flycatcher. Management options available over the 10-year consultation period include limited water management options during dry years, especially during Article VII restrictions. However, water management options for stored water, supplemental water, possible silvery minnow conservation water, and examinations of diversions exist, and were analyzed in determining the reasonable and prudent alternative below.

In formulating this RPA, we recognized that the Middle Rio Grande could be under restricted water conditions throughout the ten year period of this consultation. These conditions impact the silvery minnow and flycatcher. The parties mentioned in the biological opinion have been working together to increase management capabilities to benefit the listed species. Parties to the consultation have demonstrated their willingness to seek long term solutions to the water management challenges facing the Middle Rio Grande Basin in a collaborative manner. We welcome and appreciate the cooperative effort and commend all parties for their contributions. We have determined that significant impacts will occur to the listed species, however, we are optimistic that the following RPA will reduce the impacts to the listed species.

The following items are elements of the single reasonable and prudent alternative:

Water Operations Elements

The following elements apply in all years.

A) Parties to the consultation shall provide flows such that the river does not become intermittent in May prior to the silvery minnow spawn.

B) Between April 15 and June 15 of each year, parties to the consultation shall provide a one-time increase in flows (spawning spike) to cue spawning. The need for, magnitude, and duration of this flow spike will be made in coordination with the Service.

C) Reclamation shall cooperate with the MRGCD to use Federal drains and other works operated by MRGCD in a manner likely to provide refugia in the river for the silvery minnow. Potential works will be determined in coordination with the Service and other agencies.

D) In coordination with the Service, Reclamation and the Corps shall release any supplemental water (from any established conservation water pools, etc.) in a manner that will most benefit listed species.

Rationale – The intent of these elements is to provide as much habitat as possible for the silvery minnow and flycatcher. Managing the available water as efficiently as possible is necessary to create as many management options as possible.

E) Parties to the consultation shall conduct daily monitoring of river flow conditions when flows are 300 cfs or less at San Acacia, and report information daily to the Service through the water operations conference calls and meetings.

Rationale – Having current information on the flows will allow the Service to react quickly to rapidly changing conditions on the river (such as thunderstorm events) and facilitate better coordination among agencies.

F) The parties to this consultation shall ensure that all flycatcher territories that can be kept wet by pumping water from the LFCC are provided with surface water from June 16 until September 1. If river flows recede upstream of other, more northern flycatcher sites or territories, options for providing water to those sites shall be accomplished either by pumping, or diverting water from, riverside drains and shall be coordinated with the Service. The location and extent of wet habitat shall be coordinated with the Service for each territory or site. The decision to characterize a flycatcher territory or site as infeasible to keep wet shall be coordinated with the Service.

Rationale – The presence of surface water is considered one of the most important factors in determining suitable flycatcher breeding sites. Providing the necessary water under and around nest sites should encourage flycatchers to continue their breeding attempt. Renesting is known to occur at numerous Middle Rio Grande sites and egg laying can continue during August. For this reason, water in proximity to territories is needed through September 1 of each year.

The following water operation elements are designed specifically for dry, average, or wet years. For the purposes of this consultation dry, average, and wet years are defined as follows based on the Natural Resources Conservation Service's April 1 stream flow forecast:

Dry year: NRCS April 1 Stream Flow Forecast at San Marcial is less than 80 percent of average,
Average year: NRCS April 1 Stream Flow Forecast at San Marcial is 80 to 120 percent of average, and
Wet year: NRCS April 1 Stream Flow Forecast at San Marcial is 120 percent or higher of average

Each year will be assessed individually. However, there are so many variables (e.g. amount of water stored, availability of supplemental water, Compact restrictions, level of the shallow groundwater table, soil moisture) it is impossible to accurately predict actual runoff based on winter precipitation. For that reason, the amount of discharge in the river may be significantly lower or higher than what is predicted to occur. For example, in a year when the predicted runoff is 100 percent, but which follows one or more dry years, the actual runoff may only be 60 percent of normal. If this situation occurs, the Service has the option to write an amendment to this biological opinion that will change the flow recommendations from an average year scenario to a dry year scenario.

Because of gage error and the fluctuations in river flow, the Service recognizes the difficulties in maintaining a specific minimum flow. Because of these difficulties, the flows might drop below the minimum required for very short durations. These minor fluctuations may not necessarily trigger the need for reinitiation of consultation. Therefore, Reclamation and the Corps, in coordination with the Service, will develop protocols and procedures for monitoring deviations from the minimum flow requirements for reinitiation purposes. These protocols and procedures shall be developed within 30 days of the date of this biological opinion.

Dry years and when Article VII of the Compact is in effect

G) From May 1 to June 15, provide a minimum flow of 300 cfs at the Central Bridge gage. From June 16 to April 30, a minimum flow of 100 cfs will be maintained at the Central Bridge gage.

Rationale – The May 1 to June 15 flow is expected to protect silvery minnow YOY from an accidental discharge of ammonia from the Albuquerque WWTP. The amount of flow is based on the following analysis. Several releases of ammonia have occurred at the Albuquerque WWTP in recent history (Figure). We assumed that an upset of 15 mg/L of ammonia was a concentration that was reasonably likely to occur in the future and that the discharge from the Albuquerque WWTP will be 70 cfs as stated in the BA. We also assume that concentrations of ammonia less than or equal to 3.1 mg/L will not harm silvery minnow larvae. Based on these assumptions, the amount of dilution (river) flow needed to protect silvery minnow larvae (as measured at the Central Bridge gage) is 300 cfs (Abeyta and Lusk, in litt 2003). Adult silvery minnow are less sensitive to ammonia than are the larvae. For this reason a lesser dilution flow is needed after June 15. The primary concern after June 15 is to keep the river connected throughout the Cochiti and Angostura Reaches and to provide at least a minimal amount of habitat for the adults and juveniles through the summer months. These reaches of the Rio Grande are integral to augmentation efforts, with over 100,000 fish being planted there. It is essential to provide a sufficient amount of habitat to support these silvery minnows.

H) The parties to this consultation shall use appropriate methods to improve the quality of treated wastewater entering the Rio Grande. These may include: (1) Create a protective wetland around effluent outfalls of sufficient size to allow for the dissipation/degradation of ammonia and chlorine before the waste water is released to the Rio Grande; the outfall should be screened to prevent silvery minnow from entering the wetland, (2) WWTPs on the Rio Grande will exclude silvery minnow from their effluent plumes until the effluent enters the Rio Grande, (3) Install ultraviolet disinfection at the WWTPs, and (4) Mix/aerate the WWTP effluent before it enters the Rio Grande to dissipate ammonia and/or chlorine.

Rationale – Albuquerque WWTP is permitted to release up to 118 cfs. If this maximum were reached in the 10 year time frame of this project, the dilution flow required from May 1 to June 15 would be 500 cfs (as measured at the Central Bridge gage). However, we expect this RPA will lessen the threat of poor water quality on silvery minnow so that the minimum flow will not need to be increased from 300 to 500 cfs.

I) Pump from the LFCC as soon as needed to manage river recession. The pumping capacity must meet or exceed the total capacity of pumps used in the 2002 irrigation season (150 cfs). Pumping shall continue even if river flow has receded upstream of any particular pump to continue to benefit the flycatcher and its habitats. Dewatered areas upstream, downstream, and between pumps shall be surveyed for the presence of breeding flycatchers and pumping implemented, if feasible, where breeding flycatchers are found. Location of pumps and decisions regarding cessation of pumping will be made in coordination with the Service.

Rationale – The presence of surface water is considered one of the most important factors in determining suitable flycatcher breeding sites. Providing the necessary moisture under and around nest sites should encourage flycatchers to continue their breeding attempt.

Average Years

J) From May 1 to June 15 of each year, provide a minimum flow of 100 cfs at Isleta Diversion Dam and 50 cfs at the San Marcial Floodway gage. From June 16 to July 1 of each year, ramp down the flow to achieve 50 cfs over San Acacia Diversion Dam and maintain through October 31. From November 1 through April 30 provide river flow from Cochiti Dam to Elephant Butte Reservoir with a target flow of 50 cfs at the San Marcial Floodway gage.

K) Pump from the LFCC if needed to manage river recession and maintain connectivity. The pumping capacity must meet or exceed the total capacity of pumps used in the 2002 irrigation season (150 cfs). Pumping shall continue even if river flow has receded upstream of any particular pump if the Service determines it benefits the flycatcher and silvery minnow and their habitats. Dewatered areas upstream, downstream, and between pumps shall be surveyed for the presence of breeding flycatchers and pumping implemented, if feasible, where breeding flycatchers are found. Location of pumps and decisions regarding cessation of pumping will be made in coordination with the Service.

Rationale – These elements will provide the essential constituent elements needed to sustain the silvery minnow, which include sufficient flowing water to supply food and cover for all life stages; prevention of degradation of water quality as a result of stagnation (elevated temperatures, decreased oxygen, carbon dioxide build-up, etc.); and adequate water quantity to prevent streambed dessication, and/or the formation of management-caused isolated pools. Water is a necessary component for all silvery minnow life-history stages and provides for hydrologic connectivity to facilitate fish movement. This water will provide water adjacent to flycatcher nesting areas, which is an element of their preferred breeding habitat. These flows will also assist in producing insects for flycatcher food, and for maintaining and regenerating essential riparian vegetation for flycatcher shelter, feeding and breeding.

Wet years

L) From May 1 to June 15 of each year, provide a minimum flow of 150 cfs at Isleta Diversion Dam and 100 cfs at the San Marcial Floodway gage. From June 16 to July 1 of each year, ramp down the flow to achieve 120 cfs over San Acacia Diversion Dam and maintain through October 31. From November 1 through April 30 provide river flow from Cochiti Dam to Elephant Butte Reservoir with a target flow of 120 cfs at the San Marcial Floodway gage.

Rationale – Higher flows are justified in wet years to allow populations of the silvery minnow and flycatcher to rebound from drought. It is expected that higher flows will lead to better recruitment and survival for both species because of increases in habitat availability and suitability. These flows will provide water adjacent to flycatcher nesting areas, which is an element of their preferred breeding habitat. These flows will also assist in producing insects for flycatcher food, and for maintaining and regenerating essential riparian vegetation for flycatcher shelter, feeding and breeding. Although populations will not immediately rebound, if several wet years in row occur, we anticipate that the populations of the silvery minnow and flycatcher would respond positively based on improved habitat conditions and an increase in habitat.

M) Pump from the LFCC if needed to manage river recession and maintain connectivity. The pumping capacity must meet or exceed the total capacity of pumps used in the 2002 irrigation season (150 cfs). Pumping shall continue to maintain river connectivity.

Rationale – The presence of surface water is considered one of the most important factors in determining suitable flycatcher breeding sites. Pumping will provide continuous flow for a longer period of time leading to greater insect production, increased chick survival, and potentially the opportunity for a second brood. A connected river maintains more stable water chemistry and water temperatures leading to less stress for silvery minnow. In addition food resources and nutrient cycles are not interrupted, leading to a more stable and less stressful environment for the fish. We would anticipate survival and reproductive success to increase.

Habitat Improvement Elements

Implementation of all habitat improvement elements shall address current findings from the Rio Grande Silvery Minnow Water Quality Assessment and Habitat Preference Programs.

N) To prevent or minimize destruction of potential or suitable flycatcher habitat when installing pumps or groundwater wells, Reclamation will coordinate with the Service prior to their installation if this action may affect flycatcher habitat.

Rationale – Transects through, or openings in, the riparian vegetation of suitable flycatcher habitat can fragment the habitat patch, reducing its attractiveness to newly arriving flycatchers. Fragmentation can also increase the risk of predation and parasitism to nesting flycatchers by increasing access to the nest site. Suitable habitat can be destroyed or compromised by *groundwater pumping through reduction in extent or health of riparian vegetation or by reducing production of insects needed by flycatchers for food.*

O) Improve gaging and real-time monitoring of water operations to provide dependable, accurate readings. Reclamation, in coordination with NMISC, MRGCD, and City of Albuquerque, will install gages at Tome, Highway 380, and immediately above the Albuquerque WWTP (between the Rio Bravo Bridge and the WWTP outfall). In addition, the MRGCD shall continue to install gages at all diversions, drains, returns and main ditches.

Rationale – The gaging in the past has been inadequate to reliably monitor flows. As a result, management of flows has at times resulted in intermittency. There is a need for an accurate accounting of water use. This can only be accomplished if diversions, drains and ditches are gaged. Because the effluent from the Albuquerque WWTP may become an important source of water for the silvery minnow, it is important to know how much dilution flow is arriving at the plant and what the flow is below the plant.

P) Parties to the consultation shall complete fish passage at San Acacia Diversion Dam to allow upstream movement of silvery minnows by 2008 and at Isleta Diversion Dam by 2013. A plan for monitoring the effectiveness of fish passage must be completed, funded and implemented for each year's operation and maintenance. In the interim, implement all feasible short-term fish passage/river reconnectivity actions.

Rationale – The diversion dams obstruct the silvery minnow from repopulating critical habitat upstream of the dams, and in recent years has resulted in restricting the majority of the entire population to below the San Acacia Diversion Dam.

Q) In consultation with the Service, conduct habitat/ecosystem restoration projects in the Middle Rio Grande to increase backwaters and oxbows, widen the river channel, and lower river banks to produce shallow water habitats, overbank flooding and regenerating stands of willows and cottonwood to benefit the silvery minnow and flycatcher and their habitats. Restoration will take place in at least one site per reach as defined below equal to 100 hectares (247 acres) on the Rio Grande from the area of Velarde to the headwaters of Elephant Butte Reservoir. The reaches include the following, as described in the Biological Assessment: Velarde, Española, Cochiti, Middle, Belen, Rio Puerco, Socorro, and San Marcial. This is based on the size of a successful breeding area used by a group of flycatchers on the Middle Rio Grande which encompassed approximately 24.2 hectares (60 acres). This area would equate linearly to a approximately 100 meters (328 feet) wide by 2.5 kilometers (1.6 mi) long. Therefore, within the time frame of this consultation an area approximately 100 meters (328 ft) wide by 10 kilometers (6.2 miles) long will be completed in each reach. A time table will be developed in coordination with the Service and the action agencies to determine when completion of these projects will be made. Enhancement of marginally suitable silvery minnow and flycatcher habitat, which includes those areas that may be too incised, small, sparsely vegetated or dry to be considered entirely suitable, can also fulfill this habitat improvement requirement. Enhancement includes habitat manipulation that results in making marginally suitable habitat suitable. For example, some areas of suitable habitat may occur that are only 30 acres in size. Restoration of an adjacent 30 acres could significantly improve this site for use by the silvery minnow and flycatcher. In this example, such an improvement would count 30 acres toward the habitat improvement requirement. Another example might be lowering the river bank to allow overbank flooding in a 60-acre area. This could promote willow development and shallow water habitats and result in 60 acres of marginally suitable habitat becoming suitable over time. Specifics of enhancement projects will be coordinated with the Service.

Monitoring for restoration project effectiveness to benefit the silvery minnow and flycatcher will be conducted at each site annually post-project completion in order to assess whether native riparian habitats are self-sustaining and successfully regenerating, and whether the habitats are maintaining suitability for recovery of listed species. Monitoring reports will be provided to the Service by January 31 of each year. Adaptive management principles will be used, if necessary, to obtain successful restoration of silvery minnow and flycatcher habitats. The environmental evaluation process for each project should begin when this biological opinion is issued and construction at the first restoration site should begin no later than six months from the date of this biological opinion

Rationale – Creation of riparian habitat in the river will help distribute and stabilize sediment and provide the low velocity, *backwater habitats needed by the silvery minnow and flycatcher. Overbank flooding is necessary to sustain the native riparian vegetation and wetlands that the flycatcher requires for shelter, feeding and breeding. The project size is derived from a flycatcher site on the Middle Rio Grande that has contained several nesting pairs in recent breeding seasons. Element R will alleviate jeopardy to the continued existence of the species by improving existing habitat and increasing total amount of habitat for silvery minnows by distributing sediment and providing the low velocity, backwater habitats needed by the silvery minnow*. *Low velocity habitat and silt and sand substrates provide food, shelter, and sites for reproduction, and are essential for the survival and reproduction of silvery minnow.*

R) When bioengineering cannot be used in Reclamation river maintenance projects, habitat restoration will be implemented to offset adverse environmental impacts resulting from river alteration. Habitat restoration efforts should replace the ecological functions and values of the affected area, be permanently protected sites, and be large enough in size to provide areas for foraging, breeding, and sheltering. A restoration plan, to be approved by the Service, should be produced for each restoration site that includes (but is not limited to); a) the acreage and ecological value of the habitat to be impacted and restored, b) a budget, c) measurable success criteria, d) time frames for achieving said criteria, and e) a remediation plan should the restoration site not succeed. Habitat restoration will occur within the same or adjoining reach as the river maintenance project, or in tributaries of those reaches, in consultation with the Service.

Rationale – Habitat restoration will help offset the adverse effects to silvery minnow and flycatcher habitat caused by traditional river engineering techniques. Based on the high *ecological of the riverine and riparian habitats along the Rio Grande, detailed restoration planning and implementation is necessary for ensuring no net loss of ecological function and value.*

S) The Corps, Reclamation, and the NMISC will collaborate on the river realignment and proposed relocation of the San Marcial Railroad Bridge project, which is necessary to increase the channel capacity in the lower reach of the Middle Rio Grande. The project will be initiated by 2008.

T) Each year that the NRCS April 1 Streamflow Forecast is at or above average for the mainstem Rio Grande and flows are legally and physically available, the Corps will ensure seasonal overbank flooding over baseline levels. The overbank flooding will be used to create an increased number of backwater habitats for the silvery minnow and flycatcher. The timing, amount and locations of overbank flooding will be planned each year in conjunction with the Service, and may be conducted in coordination with compact deliveries. Duration and extent of overbank flooding will be monitored annually, and the results will be reported to the Service by October 15 of each year.

U) Reclamation and the Corps shall increase sediment transport from the Jemez, and Galisteo Reservoirs, as well as other sources, to the upper reaches of the river. By 2007, Reclamation and the Corps shall investigate the feasability of transporting sediment from the Cochiti Reservoir to the upper reaches of the river.

Rationale – The purpose of elements T through V is to improve the quality and quantity of habitat available for the silvery minnow and flycatcher. It is expected that by improving the habitat condition that reproduction, recruitment, and survival of the species will increase.

V) Reclamation shall coordinate with the Corps and the NMISC, to destabilize islands by plowing or disturbance in the Angostura, Isleta, and San Acacia Reaches. The islands proposed for removal should be agreed upon by the Service, Reclamation, and the Corps. Acreage reclaimed should not adversely affect flycatcher habitat. Reclamation should cooperate with the Service to identify areas of the floodway for destabilization activities. This action may be undertaken where reaches are dry.

Rationale – This element would provide new low-velocity habitat in the existing river channel without use of large mechanical or engineering processes.

<u>Salvage and Captive Propagation Elements</u>

W) Parties to the consultation shall provide $300,000 annually to NMESFO for distribution to propagation facilities for the continuation of captive propagation activities (including egg collection, transportation, relocation, rearing, breeding, etc.). The City of Albuquerque will coordinate egg collection activities for propagation efforts and will identify egg collection locations in coordination with the NMESFO, NMFRO, and other parties to the consultation.

X) Parties to the consultation shall provide $200,000 annually for the first three years of this consultation for the expansion of facilities propagating silvery minnows (Dexter and Mora National Fish Hatcheries and Technology Centers, New Mexico Fishery Resources Office, New Mexico State University, Albuquerque Bio Park, Rock Lake State Fish Hatchery and any other approved locations).

Y) Construct two new breeding and rearing facilities for the captive propagation of the silvery minnow. The first new breeding and rearing facility must be completed by May 31, 2005, and the second new facility must be completed by May 31, 2006. One facility should be located in the Angostura Reach and the other facility should be located in the Isleta or San Acacia Reach. The design, siting, and operation of the facility should be coordinated with the Service.

Rationale – These activities (Elements X – Z) will augment captive populations and facilitate repopulation efforts in the Middle Rio Grande, as well as reintroduction efforts. The proposed action and existing drought conditions will result in massive drying events in the Angostura, Isleta, and San Acacia Reaches. To alleviate jeopardy to the silvery minnow, egg collection and captive propagation activities will be of increased importance for maintaining silvery minnow numbers and genetic diversity during times when adequate habitat (i.e., river flow) is not available in the wild. Because extensive drying is expected to occur in a large portion of the silvery minnow's habitat, there will need to be a more intensive effort to collect eggs during the spawn, and transport them to captive facilities for hatching and rearing. In addition, the successful breeding and rearing of silvery minnows will be essential for providing captive stock that can be used for augmentation efforts within the Middle Rio Grande, as well as for reintroduction efforts in currently unoccupied areas within the silvery minnow's historic range. The capacity of the current captive propagation facilities must be expanded to accommodate the increased number of silvery minnows that will need to be housed in captive facilities. Since there will be less habitat available for maintaining populations in the wild, an increased emphasis on captive rearing and breeding is necessary.

Z) Parties to the consultation, beginning in 2008, shall provide the NMESFO $100,000 annually for five years for monitoring and augmentation of silvery minnows reintroduced under section 10(j) (experimental populations) of the ESA.

Rationale – To meet the goals set forth in the Rio Grande Silvery Minnow Recovery Plan, the Service must establish populations outside of the Middle Rio Grande, within the silvery minnow's historic range. The reintroduction of the silvery minnow to other locations would reduce the likeliness that any single catastrophic event could result in the extinction of the species, and would help to insure the long-term survival and recovery of the species. The service received $200,000 in 2002 for reintroduction efforts. Those funds have initiated a baseline habitat study at Big Bend National Park. The 2002 funds are sufficient to complete NEPA and promulgation of the 10(j) proposed and final rule, and begin reintroduction efforts. Scoping and NEPA activities will begin in FY 2003. Initial augmentation and monitoring activities will occur by 2008.

AA) New Mexico Department of Game and Fish, in conjunction with the NMESFO, shall conduct silvery minnow surveys and habitat assessment studies in the Rio Grande above Cochiti Reservoir in preparation of silvery minnow releases under the Service's Regional Director's 10(a)(1)(A) permit. The reintroduction will be considered experimental and all silvery minnows will be marked. This activity will be completed by the end of 2004.

Rationale – Silvery minnow surveys and habitat assessments in the reach of the Rio Grande above Cochiti Reservoir will provide information necessary to determine the feasability of releasing silvery minnow in this area.

<u>Water Quality Elements</u>

BB) Parties to the consultation shall provide funding for the continuation and completion of the ongoing Water Quality Assessment Program. The current program should be expanded so that water quality associated with the Bernalillo and Los Lunas WWTPs, storm runoff, irrigation, and riverside drains can also be evaluated. Toxicity testing of silvery minnows and/or their surrogates should be conducted using treated effluent, storm runoff, irrigation return flow, riverside drains, and in response to the results of the Water Quality Assessment Program.

CC) New Mexico Environment Department, in coordination with NMESFO, shall initiate a long term water-quality monitoring program in response to results of the Water Quality Assessment Program. This should include continuous water quality monitoring at selected sites in the Middle Rio Grande, such as below the Albuquerque, Bernalillo, Rio Rancho, and Los Lunas WWTP outfalls, stormwater channels, and irrigation return drains.

DD) Parties to the consultation shall provide for continuous monitoring, recording, and real-time reporting on a publicly accessible website, of chlorine and ammonia in the City of Albuquerque's WWTP effluent. The pollution response plan shall address exceedences of chlorine, ammonia, and other potentially toxic conditions. Monitoring of and response to chlorine and ammonia exceedences should be a high priority in this plan.

EE) The NMED shall work with the municipalities to provide for nontoxic alternatives to chlorine disinfection (e.g., ultraviolet disinfection, tertiary treatment) for all WWTPs in the project area. A nontoxic alternative to chlorine disinfection should be implemented by the City of Albuquerque and Town of Bernalillo by 2006. Non-toxic alternatives to chlorine disinfection should be implemented by other WWTPs in the Middle Rio Grande by 2013.

Rationale – The rationale for these water quality elements is to reduce or eliminate the threats to silvery minnow due to poor water quality. Although the lethality of some toxic substances is well documented (i.e., ammonia and chlorine), the toxicity of other compounds is not well known. In addition, the chronic effects of many toxic substances either alone or in combination are not known for silvery minnow. A comprehensive water quality assessment and monitoring program *will provide information and allow managers to better evaluate important water quality issues as they relate to silvery minnow health and habitat. Additional pollution response planning will allow for a faster response time to potentially toxic accidental spills and chemical releases. A nontoxic alternative to chlorine disinfection should be implemented by WWTPs along the Middle Rio Grande so that the threat of excess chlorine in the river will be removed.*

With the minimum flows we are requiring we recognize that we are providing no protection to the silvery minnow from discharges of chlorine, an element to which both larvae and adults are very sensitive at low concentrations (11 parts per billion are lethal). However, discharges of chlorine have been less frequent than those of ammonia and the amount of water necessary to protect the fish are simply not available. We expect that the installation of non-chlorine disinfection will eliminate this threat to silvery minnow.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the Federal agencies so that they become binding conditions of any Federal grant or permit issued to any non-Federal water users, as appropriate, for the exemption in section 7(o)(2) to apply. The Federal agencies have a continuing duty to regulate the activity covered by this incidental take statement. If the Federal agencies (1) fail to assume and implement the terms and conditions or (2) fail to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Federal agencies must report the progress of the action and its impact on the species to the service as specified in the incidental take statement. [50 CAR §402.14(i)(3)]

<u>Amount or Extent of Take Anticipated</u>

The Service has developed the following incidental take statement based on the premise that the reasonable and prudent alternative will be implemented.

Rio Grande Silvery Minnow

The Service anticipates that up to 25,000 adult silvery minnows and 25,000 silvery minnows under 30 millimeters in total length may be taken in any year due to the Federal and non-Federal actions described and analyzed in this biological opinion. It is the Service's opinion that approximately one of every fifty silvery minnows that are injured or killed will be found because of predation, the cryptic nature of the silvery minnow, and its small size. This approximation was determined based on salvage activities and field observations during the 2001 and 2002 irrigation seasons. The total number of pools during the onset of intermittence is unknown, and it is likely that several other pools were present but not sampled. Smith (1999) determined that typical isolated pools only persisted for a few days before drying; however, larger more infrequent pools may last for several days (Smith and Hagstrom 1997).

In 1999, Smith (pers. comm.) sampled isolated pools in relation to another study and determined that silvery minnows were present in both large and small pools. During this sampling foray a large isolated pool under the San Marcia Railroad Bridge was sampled for silvery minnows and only a few were collected. However, sampling two days later by University of New Mexico personnel determined that several hundred silvery minnows were in the pool and documented 144 dead silvery minnows (Platania and Dudley 1999). It was also noted by Platania and Dudley (1999) that many predator tracks, most likely great blue herons, were found adjacent to these pools. Therefore, it can be inferred that many dead silvery minnows were consumed by predators before this sample was collected. Predatory birds have been seen hunting and consuming fish from isolated pools during river intermittence (pers. comm., Jude Smith). Though the number of fish present in any pool is unknown, it must be assumed that many of the fish preyed upon in these pools are silvery minnows.

Therefore, using the best scientific information and methodology available, if more than 500 adult silvery minnows or 500 silvery minnows under 30 millimeters in total length are found dead in any year, the level of anticipated take will have been exceeded. Live silvery minnows rescued from isolated pools will not be counted toward incidental take for this consultation. Silvery minnows found dead in lateral isolated pools created by increased flows from storm events will not count toward incidental take for this consultation. Silvery minnows found dead in lateral isolated pools caused by water management, which results in fluctuations in flows or intermittence will count toward incidental take. This take will be in the form of harm and harassment.

The Service also anticipates that no more than 100,000 silvery minnow eggs each year will be taken through entrainment at the diversion facilities on the river. Take of eggs will occur in the form of harm, wound, and kill.

This is the total level of take anticipated for the proposed actions of all Federal agencies and non-Federal water users as described in the Description of Proposed Action section of this biological opinion.

Because the river maintenance portion of the proposed action will require project-specific consultations, including those activities proposed on pages 34-36 and 38-42 of the June 29, 2001, biological opinion, any incidental take resulting from those activities will be analyzed and covered, as appropriate, in future biological opinions.

Southwestern Willow Flycatcher

We anticipate that three existing flycatcher territories will be dried this year as a result of this action (LF-04, 33, and 43a), and that these birds will be harassed from their territories by habitat modification through dewatering and forced to relocate, possibly causing harm to any offspring that may be produced. In future years, if an average or wet year is followed by a dry year, some flycatchers may be harassed into relocating again. We anticipate incidental take of three flycatcher pairs and their offspring per year for the four additional dry years predicted to occur during this consultation period. Therefore, the total amount of incidental take anticipated for the southwestern willow flycatcher is 15 flycatcher pairs and their offspring. In some cases, these territories may only contain males that are thought to be unpaired.

This is the total level of take anticipated for the proposed actions of all Federal agencies and non-Federal water users as described in the Description of Proposed Action section of this biological opinion.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow or the flycatcher when the reasonable and prudent alternative is implemented.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the silvery minnow.

1) Parties to the consultation shall minimize the take of silvery minnows within the Rio Grande.

2) Parties to the consultation shall minimize the take of silvery minnows due to river diversions.

3) Parties to the consultation shall minimize the take of silvery minnows and flycatcher from a lack of water availability.

4) The loss of flycatcher territories through drying shall be minimized.

5) Reduced flycatcher reproductive success due to cowbird parasitism shall be minimized.

Terms and Conditions

Compliance with the following terms and conditions must be achieved in order to be exempt from the prohibitions of section 9 of the ESA. These terms and conditions implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. The salvage of silvery minnows (eggs, larvae, and adults) requires an ESA section 10(a)(1)(A) permit from the Service and such take is not covered by this incidental take statement.

To implement Reasonable and Prudent Measure 1, parties to the consultation shall:

1.1) Ramp down river flows as slowly as possible from the time of the spawning spike until June 15. Even under the worst conditions ,no more than four miles of river should dry per day in the Isleta and San Acacia Reaches. Ramping down the flows will allow a month for the silvery minnow larvae to grow. It will also make salvage operations more manageable and allow time for monitoring the effects of drying.

1.2) In years when the river becomes intermittent, in coordination with the Service, seine isolated pools as the river recedes. The sampling protocol developed by NMESFO will be used. NMESFO will coordinate stakeholder participation, data collection, and translocation of the silvery minnows. This will minimize take by rescuing silvery minnows to the maximum extent practicable.

To implement Reasonable and Prudent Measure 2, parties to the consultation shall:

2.1) During the silvery minnow spawn, the MRGCD, in coordination with the NMESFO, shall operate irrigation diversion structures in a manner that will minimize the entrainment of eggs and larvae into the irrigation system and allow for egg collection in the river when necessary. This will minimize take of eggs and larvae that is associated with irrigation diversions while creating conditions within the river channel to allow for egg collection activities.

2.2) Collect silvery minnow eggs on a daily basis from May 1 through May 31 at all diversion dams, as well as other locations within the river channel. This will minimize take by rescuing silvery minnow eggs to the maximum extent practicable.

To implement Reasonable and Prudent Measure 3, parties to the consultation shall:

3.1) Continue to seek and release supplemental water from all available sources. This will minimize take by ensuring that as much habitat as possible is available for the silvery minnow and flycatcher.

3.2) Encourage water users to willingly provide supplemental water for the benefit of the species. This will minimize take by ensuring that as much habitat as possible is available for the silvery minnow and flycatcher.

To implement Reasonable and Prudent Measure 4, parties to the consultation shall:

4.1) Purchase pumps that shall be designated for pumping irrigation return flows into established sites which are drying. Reclamation shall retain the appropriate permits for installation and operation of this pump prior to March 30 of each breeding season. The installation of this pump shall be determined on a case by case basis, in conjunction with the Service. After September 1, this pump may be used for silvery minnow conservation.

To implement Reasonable and Prudent Measure 5, parties to the consultation shall:

5.1) Continue to monitor cowbird parasitism in known flycatcher nesting habitat. If parasitism levels above 5 percent are documented, Reclamation will reinitiate a cowbird trapping program in areas with elevated parasitism levels.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Research the effects of turbidity and suspended sediment on silvery minnow.

2. Determine the effects of sediment toxicity on silvery minnow.

3. Conduct studies of silvery minnow diet and sediment ingestion.

4. Conduct studies of how effluents from the WWTPs mix with water from the Rio Grande at various discharges.

5. Provide for citizen education and outreach regarding prevention of pollution to water resources and the effects that pollution has on river ecosystems.

6. Sponsor voluntary citizen monitoring of the Rio Grande.

7. Parties to the consultation shall develop an agricultural forbearance program that could provide additional supplemental water for the conservation of the silvery minnow and flycatcher.

8. Work with the Endangered Species Act Collaborative Program Interim Steering Committee, Natural Resource Conservation Service, and other parties to the consultation to develop a program for conversion of high water-use crops to lower water-use crops, and increases in agricultural efficiencies. Determination of how the water savings can be applied to conservation activities (i.e. supplemental water program) being undertaken for the silvery minnow and flycatcher.

9. Monitor/study silvery minnow spawning throughout the irrigation season in the Angostura, Isleta, and San Acacia Reaches.

10. Parties to the consultation shall continue to work collaboratively to develop and implement a long-term plan to benefit the recovery of the silvery minnow and flycatcher.

11. Survey and monitor all suitable flycatcher habitats throughout the action area annually. Map and monitor all suitable and potential flycatcher habitats within the action area.

12. Provide funding ($125,000) for research to better understand micro- and macro-habitat characteristics of occupied flycatcher habitat and methods to most successfully restore it in the action area. Plan this research in coordination with the Service. Begin to implement the findings as soon as available in the restoration and adaptive management projects for the flycatcher described in the Reasonable and Prudent Alternative.

13. Develop a contingency plan in the event of wildfire in flycatcher habitat that would reduce impacts to endangered species.

14. Monitor fluctuations of groundwater in the shallow and deep aquifers to better understand the groundwater - surface water relationship.

16. If a long-term solution has not been successfully implemented (habitat restoration in the upper reaches, successful captive propagation program, river re-connectivity, successful repopulation efforts, etc.), the Corps should work with the State to make more water available proportionate to credit status, if the State remains in a credit status.

17. Implement a strategy to improve water management/efficiency related to the irrigation system (e.g., changing irrigation practices, etc.) in coordination with an interagency advisory group. Any water savings gained from these actions should be made available for use as supplemental water for the benefit of listed species.

18. Encourage adaptive management of flows and conservation of water to benefit listed species.

19. Parties to the consultation should secure storage space and acquire water rights to create a permanent conservation pool to benefit endangered species.

20. Parties to the consultation shall provide funding for the continuation and completion of the ongoing Rio Grande Silvery Minnow Habitat Preference Program.

21. The NMDA is currently administering the New Mexico Salt Cedar Control Project through local soil & water conservation districts along the Rio Grande. The NMDA should continue this effort and in order to avoid and minimize impact to flycatcher. The NMDA, in conjunction with the parties to this consultation, should: (1) Ensure no active flycatcher territories are treated prior to treating an area, and (2) seek funding for restoration of suitable (or potential) flycatcher habitat which is removed as a result of the New Mexico Salt Cedar Control Project.

22. Reclamation and the NMISC should take measures to prevent unauthorized use of water intended for silvery minnow conservation within the Rio Chama and Middle Rio Grande watersheds.

23. Reclamation should address the flycatcher population within the reservoir pool of Elephant Butte Reservoir. Within one year of the signature date for this biological opinion, in consultation with the Service, the Bureau should address the flycatcher population within the high water mark of Elephant Butte Reservoir.

24. Parties to the consultation, in coordination with the Service, should take steps necessary to obtain variances from NMED to introduce sediment into the Rio Grande where needed to create habitat for the silvery minnow.

<u>Reinitiation Notice</u>

This concludes formal consultation on the action(s) outlined in the February 18, 2003, request. As provided in 50 CAR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. This consultation is valid until February 28, 2013. Consultation must be reinitiated prior to the expiration of this biological opinion to ensure continued compliance with sections 7 and 9 of the ESA. Deviations from any environmental commitments may require reinitiation of consultation. If territorial flycatchers are documented in habitat that may be affected by dewatering caused by the proposed action, or if occupied flycatcher nests may be inundated by flood water caused by the proposed action, the Service must be contacted for further consultation.

In instances where the amount or extent of incidental take is exceeded, any Federal operations causing such take must cease pending reinitiation, except during flood control operations.

In future correspondence on this project, please refer to consultation number 2-22-03-F-0129. Please contact Dr. Joy Nicholopoulos of our New Mexico Ecological Services Field Office at 505-761-4706, if you have any questions or would like to discuss any part of this biological opinion.

Sincerely,

Regional Director

cc: Supervisor, Ecological Service Field Office, Albuquerque, NM
Assistant Regional Director, Region 2 (ES)
Regional Section 7 Coordinator, Region 2 (ES)

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